A MATURITY LEVEL ASSESSMENT OF THE USE OF GENERALISED AUDIT SOFTWARE BY INTERNAL AUDIT FUNCTIONS IN THE SOUTH AFRICAN BANKING INDUSTRY

by

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DECLARATION

I declare that the dissertation hereby submitted for the qualification Philosophiae Doctor in Auditing at the University of the Free State is my own independent work and that I have not previously submitted the same work for a qualification at or to another university or faculty.

L.A. Smidt **DATE**

L.A. Smidt **DATE**

DEDICATION

I dedicate this study to my wife, Suzette and to my sons, Ludian and Lenroux. The success of this study is as a result of your love and support. I also dedicate this study to my parents, Louis and Annetjie for their support and guidance throughout my life and studies. I also dedicate this to my parents-in-law, Sollie and Susan, with thanks for your prayers and words of encouragement throughout this study process.

INTERNATIONAL RESEARCH DURING CANDIDATURE

The following two international research projects commenced during the candidature:

- A maturity assessment of the use of generalised audit software by internal audit functions of the Federal Government in Canada. This study is conducted with support from the Canadian Office of the Comptroller General – Internal Audit Policy and Communications.

- A maturity assessment of the use of generalised audit software by internal audit functions in the Portuguese banking industry. This study is co-authored by Professor F. Geada (the president of the Portuguese Institute of Internal Auditors) together with Dr. I. Pedrosa (a lecturer in Information Systems Auditing at Coimbra Business School – ISCAC).

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ABSTRACT

Today's business practices are characterised by accelerating growth in the use of technology and "big data". It is almost unthinkable now for any organisation to function successfully without relying on its underlying information technology infrastructure: this is especially pertinent within the banking industry. Banking practices are no longer restricted to one country or jurisdiction but are characterised by cross-border transactions in multiple countries under a plethora of different legal and regulatory frameworks. For this reason, banks are reliant on a global network of data processing and information management systems to provide their core banking services and to enable them to effectively manage the macroeconomic elements of their industry. This cross-border interaction between international banks increases the systemic nature of risk in that in the event that an unwanted incident occurs it will almost inevitably affect more than just a single branch or company. The global financial crisis that occurred in 2007 was evidence of the systemic nature of risk to which the financial industry was (and remains) exposed. It further provided proof that no organisation or bank is too big or too powerful to escape unaffected. It further emphasised that excessive risk taking can be detrimental to the existence of an organisation, which in turn validated the necessity for organisations, and especially banks, to make use of reliable and independent assurance functions. As a consequence of the crisis, the banking industry continues to face ongoing and intense scrutiny by investors, the public and the banking industry's own supervisors. In addition, increased reliance has been placed on the value that an internal audit function can contribute by enhancing a bank's internal control environment. Internal audit, as one of an organisation's independent assurance providers, is tasked with the important responsibility of providing an opinion regarding the effectiveness of governance, risk management and the internal controls of an organisation.

However, the internal audit function today has to conduct its duties in control environments that are dominated by information technology and big data. In the same way that organisations' and especially banks' business models have been transformed as a result of the increased use of technology and the ever growing generation of and reliance on big data, it has equally impacted the manner in which internal audit is practiced today. This study is therefore motivated by the interest in

understanding the use of technology-based tools (more specifically the use of GAS) by internal audit functions in the locally controlled South African banks.

This study comprises a literature review and an empirical investigation. The literature review was undertaken to gain insight into the extent and applicability of the use of GAS by the internal audit profession, and more specifically the internal audit functions of the locally controlled South African banks. The literature review indicates that the use of GAS by internal audit functions is still at a relatively low level of maturity, despite the accelerating adoption of information technology and generation of big data within organisations. The literature review was then followed by empirical research. The results of this empirical study also confirm that the maturity of the use of GAS by the internal auditors employed by locally controlled South African banks is still lower than expected, given that we are now fully immersed in a technological-driven business environment.

The empirical research component was conducted using a structured questionnaire. The structured questionnaire was developed to collect data regarding the use of GAS by the internal auditors employed by locally controlled South African banks, and specifically to address the following objectives:

(1) To measure the existing practices of internal audit functions in the locally controlled South African banking industry regarding the use of GAS, against a benchmark developed from recognised data analytic maturity models, in order to assess the current maturity levels of the locally controlled South African banks in the use of this software for tests of controls;
(2) To explore and identify the purposes for which GAS is presently being used by these internal audit functions; and
(3) To develop recommendations that may assist internal audit functions in the locally controlled South African banking industry to reach their desired maturity levels.

Opinions and perceptions were obtained from 9 of the 10 heads of internal audit departments that comprise the locally controlled segment of South Africa’s banking industry. This high response rate enabled the researcher to reach meaningful conclusions and make recommendations regarding the current preferences and applications of GAS employed by these internal audit functions. In addition, the results of this study have provided a deeper understanding of the current level of maturity of the use of GAS by the internal auditors employed by locally controlled South African banks. In addition, the results provide useful insights for internal audit practitioners, GAS vendors, professional auditing bodies (such as the IIA and ISACA), academia and researchers.

Keywords: Audit evidence, Big data, Chief Audit Executive, Computer Assisted Audit Techniques, Control environment, Internal audit, Generalised Audit Software, Technology-based tools, Tests of controls.

Cut-off dates for study purposes

For the purposes of this study, references consulted regarding professional standards, relevant laws and regulations and other related best practices are those that were valid and in force up to and including 30 November 2016. Any new standards, laws and/or regulations and other best practice guidelines released or promulgated subsequent to this cut-off date will be addressed in research that will be undertaken following the submission of the thesis. It should be noted that it was the 2009 King Report on Corporate Governance for South Africa (King III Report) that was primarily referred to in the literature review despite the publication of a new edition of the King Report on Corporate Governance for South Africa (King IV Report) on 1 November 2016. Although the guidelines contained in the King IV Report only become effective on 1 April 2017 (well after the cut-off date defined for this study) this was deemed sufficiently immanent to justify including them in the literature review (where applicable) for the sake of completeness. Similarly, the Institute of Internal Auditors issued the 2016 edition of the International Standards for the Professional Practice of Internal Auditing on 1 October 2016. This edition of the standards however only becomes effective on 1 January 2017 which is also subsequent to the cut-off date defined for this study. A comparison between the current edition (effective until 31 December 2016) and the next edition of the Standards revealed no major changes in those standards that were applicable to this study.

KORTBEGRIP

Hedendaagse besigheidspraktyke word gekenmerk deur versnellende groei wat die gebruik van tegnologie en "groot data" betref. Dis nou byna ondenkbaar dat enige organisasie suksesvol kan funksioneer sonder om op sy onderliggende inligtingstegnologie-infrastruktuur staat te maak: dit geld veral in die bankbedryf. Bankpraktyke is nie meer tot een land of regsgebied beperk nie, maar word gekenmerk deur oorgrenstransaksies in meer as een land onder 'n magdom verskillende regs- en regulerende raamwerke. Om hierdie rede steun banke op 'n wêreldwye netwerk van dataverwerking- en inligtingsbestuurstelsels om hulle kernbankdienste te kan voorsien en hulle in staat te stel om die makro-ekonomiese elemente van hul bedryf doeltreffend te bestuur. Hierdie oorgrensinteraksie tussen internasionale banke verhoog die sistemiese aard van risiko aangesien die voorkoms van 'n ongewenste insident feitlik onvermydelik meer as net 'n enkele tak of maatskappy sal raak. Die wêreldwye finansiële krisis wat in 2007 plaasgevind het, was bewys van die sistemiese aard van die risiko waaraan die finansiële bedryf blootgestel was (en steeds is). Dit het ook bewys dat geen organisasie of bank te groot of te sterk is om onaangeraak daaraan te ontkom nie. Dit het ook beklemtoon dat die buitensporige neem van risiko nadelig vir die voortbestaan van 'n organisasie kan wees, wat op sy beurt onderstreep hoe noodsaaklik dit vir organisasies, en veral banke, is om betroubare en onafhanklike versekeringsfunksies te gebruik. As gevolg van die krisis, kom banke steeds te staan voor deurlopende en deurtastende ondersoeke deur beleggers, die publiek en die bankbedryf se eie toesighouers. Boonop word daar baie meer staatgemaak op die waarde wat 'n interne ouditfunksie kan toevoeg deur 'n bank se interne kontrolemilieu te verhoog. Die belangrike verantwoordelikheid om 'n mening oor die doeltreffendheid van die korporatiewe bestuur, risikobestuur en interne kontrole van 'n organisasie te huldig word aan die interne ouditfunksie, as een van 'n organisasie se onafhanklike versekeringsverskaffers, opgelê.

Die interne ouditfunksie moet egter deesdae sy pligte in 'n kontrolemilieu uitvoer wat deur inligtingstegnologie en groot data oorheers word. Op dieselfde wyse as wat organisasies, en veral banke, se besigheidsmodelle as gevolg van die verhoogde gebruik van tegnologie en die steeds toenemende skepping van, en steun op, groot data verander het, het dit ’n uitwerking gehad op die manier waarop interne oudit tans uitgevoer word. Die motivering vir hierdie studie lê dus in die belangstelling daarin om die gebruik van middele wat op die tegnologie gebaseer is (in die besonder die gebruik van GAS) deur interne ouditfunksies in die plaaslik beheerde Suid-Afrikaanse banke te verstaan.

Hierdie studie behels ’n literatuuroorsig en empiriese ondersoek. Die literatuuroorsig is onderneem om insig te verkry oor die omvang en toepaslikheid van die gebruik van GAS deur die interne-ouditberoep, en meer spesifiek die interne-ouditfunksies van die plaaslik beheerde Suid-Afrikaanse banke. Hierdie literatuuroorsig dui aan dat die gebruik van GAS deur interne-ouditfunksies steeds op ’n betreklik lae vorderingsvlak is ondanks die versnellende aanneming van inligtingstegnologie en die skepping van groot data binne organisasies. Die literatuuroorsig is gevolg deur empiriese navorsing. Die resultate van hierdie empiriese studie het ook bevestig dat die gebruik van GAS deur die interne ouditeure wat in diens van plaaslik beheerde Suid-Afrikaanse banke is, steeds laer is as wat verwag is, gegee dat ons nou ten volle deel van ’n tegnologies gedrewe besigheidsmilieu is.

Die empiriese navorsing is met behulp van ’n gestruktureerde vraelys uitgevoer. Die gestruktureerde vraelys is opgestel om data oor die gebruik van GAS deur interne ouditeure wat in diens van plaaslik beheerde Suid-Afrikaanse banke is, in te samel en spesifiek die volgende doelwitte aan te spreek:

(1) Om die bestaande praktyke van interne-ouditfunksies in die plaaslik beheerde Suid-Afrikaanse bankbedryf met betrekking tot die gebruik van GAS te meet aan ’n norm wat uit erkende datamodelle vir die ontleding van vordering ontwikkel is om sodoende die huidige vorderingsvakke van die plaaslik beheerde Suid-Afrikaanse banke ten opsigte van die gebruik van hierdie sagteware vir kontroletoetsing te bepaal;
(2) Om uit te vind wat die doeleindes is waarvoor GAS tans deur hierdie interne-ouditfunksies gebruik word en dit te identifiseer; en

(3) Om aanbevelings te doen wat dalk interne-ouditfunksies in die plaaslik beheerde Suid-Afrikaanse bankbedryf kan help om hul gewenste vorderingsvlakke te bereik.

Die menings en persepsies van 9 uit die 10 hoofde van interne-ouditafdelings waaruit die plaaslik beheerde segment van Suid-Afrika se bankbedryf bestaan, is verkry. Hierdie hoë responskoers het die navorser in staat gestel om tot betekenisvolle gevolgtrekkings te kom en aanbevelings te doen oor die huidige voorkeure en toepassings van GAS wat deur hierdie interne-ouditfunksies aangewend word. Boonop het die resultate van hierdie studie ’n groter begrip van die huidige vorderingsvlak ten opsigte van die gebruik van GAS deur die interne ouditeure wat deur plaaslik beheerde Suid-Afrikaanse banke in diens geneem word, bewerkstellig. Die resultate het ook nuttige insigte aan interne-ouditpraktisyns, GAS-handelaars, professionele ouditinstansies (soos die IIA en ISACA), akademici en navorsers verskaf.

Sleutelwoorde: Ouditbewyse, Groot data, Hoof Uitvoerende Ouditbeampte, Rekenaargesteunde ouditegnieke, Kontrolemilieu, Interne oudit, Veralgemeende ouditsagteware, Tegnologie-gebaseerde middele, Kontroletoetse.

Afsnydatums vir studiedoeleindes

Vir die doeleindes van hierdie studie is die bronne wat oor professionele standaarde, relevante wette en regulasies en ander verwante beste praktyke geraadpleeg is dié wat tot en met 30 November 2016 geldig en van krag was. Enige nuwe standaarde, wette en/of regulasies en ander riglyne oor beste praktyk wat na hierdie afsnydatum uitgereik of uitgevaardig is, sal in navorsing aangespreek word wat na die indiening van die tesis onderneem sal word. Daar moet kennis geneem word dat daar in die literatuuroorsig hoofsaaklik na die *2009 King Report on Corporate Governance for South Africa* (King III-verslag) verwys is ondanks die publisering van ’n nuwe uitgawe van die *King Report on Corporate Governance for South Afric*a (King IV-verslag) op 1 November 2016. Hoewel die riglyne in die King IV-verslag eers op 1 April 2017 in werking tree (lank na die afsnydatum wat vir hierdie studie aangegee word) is dit as inherent genoeg beskou om te regverdig dat dit ter wille van volledigheid by die literatuuroorsig ingesluit word (waar van toepassing). Net so het die Institute of Internal Auditors die 2016-uitgawe van die *International Standards for the Professional Practice of Internal Auditing* op 1 Oktober 2016 uitgereik. Hierdie uitgawe van die Standaarde word egter eers op 1 Januarie 2017 van krag, wat ook na die aangegewe afsnydatum vir hierdie studie is. 'n Vergelyking tussen die huidige uitgawe (van krag tot 31 Desember 2016) en die volgende uitgawe van die Standaarde toon geen groot veranderings in die standaarde wat op hierdie studie van toepassing is nie.

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ABBREVIATIONS

ACL	Audit Command Language
AIG	American Insurance Group
ATM	Automated Teller Machine
BIS	Bank for International Settlements
CAATs	Computer Assisted Audit Techniques
CAE	Chief Audit Executive
CBOK	Common Body of Knowledge
COSO	Committee of Sponsoring Organisations of the Treadway Commission
CSFI	Centre for the Study of Financial Innovation
ERP	Enterprise Resource Planning
EY	Ernst & Young
FSB	Financial Stability Board
GAS	Generalised Audit Software
IAASB	International Auditing and Assurance Standards Board
IDEA	Interactive Data Extraction and Analysis
IIA	Institute of Internal Auditors
IOD	Institute of Directors
IPPF	International Professional Practices Framework
IRMSA	Institute of Risk Management South Africa
ISA	International Standard on Auditing
ISACA	Information Systems and Control Association
ISO	International Standards Organisation
JSE	Johannesburg Stock Exchange
KPMG	Klynveld Peat Main and Goerdeler
LCR	Liquidity Coverage Ratio
NSFR	Net Stable Funding Ratio
PwC	PricewaterhouseCoopers
SABRIC	South African Banking Risk Information Centre
SAS	Statistical Analysis Software
UK	United Kingdom
USA	United States of America

CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION AND BACKGROUND

With the now near daily advances in technology, most organisations today are impacted by changes in information technology (IT), and these changes usually result in the generation of an increasing volume of audit evidence which is now almost exclusively available in electronic format (Ahmi & Kent, 2013:89; Committee of Sponsoring Organisations of the Treadway Commission (COSO), 2013:25; PwC, 2014:25; Institute of Internal Auditors (IIA), 2015g:14). Technology is playing an increasingly important role in the manner in which internal audit is practiced today. As a result, it is now almost impossible to conduct effective audits without the use of technology (Coderre, 2009:5; IIA, 2011:2; Olasanmi, 2013:68; Mahzan & Lymer, 2014:328). Pett predicts that by the year 2020 the internal audit function is going to be driven almost exclusively by data (cited in Jackson, 2013b:39). In the words of Chambers (current president of the IIA International), *"We are going from a period of 'Big Data' to a period of 'Mega Data', of 'Bigger than Big Data"* (cited in Jackson, 2013a:39). Chambers further highlights the importance of incorporating technology-based tools in the internal audit function's methodology. The term "Big Data" (also refer to sections 3.1 and 3.2) refers to data that is extremely large in size (in other words the volume of data) and also includes velocity (data that is available in real-time), variety and veracity (Moffit & Vasarhelyi, 2013:4; Yoon, Hoogduin & Zhang, 2015:432; IIA, 2016o:6). The variety component refers to the data that is retrieved from multiple sources (for example, blogs, video streams, website traffic and audio files), whereas veracity refers to the relevance and truthfulness of that data (Cao, Chychyla & Stewart, 2015:424; Yoon *et al*., 2015:432; IIA, 2016o:7).

Observing this trend, Coetzee (2010:4) highlights that a more streamlined audit approach is needed in order for internal audit to continue to add value in identifying risks that threaten the achievement of an organisation's objectives. Accordingly, the IIA (the authoritative professional body representing the internal audit profession globally), in the latest edition of its International Standards for the Professional

Practice of Internal Auditing (Standards), has published Standard 1220.A2, *Due Professional Care*, which requires internal auditors to utilise technology-based tools in the execution of their responsibilities (IIA, 2012a:6).

The IIA defines technology-based tools as *"Any automated audit tool, such as generalised audit software (GAS), test data generators, computerised audit programs, specialised audit utilities, and computer-assisted audit techniques (CAATs)"* (IIA, 2012a:23). The most popular and frequently used of these technology-based tools is GAS (Braun & Davis, 2003:725; Debreceny, Lee, Neo & Toh, 2005:605; Kim, Mannino & Nieschwietz, 2009:215; Lin & Wang, 2011:777; Mahzan & Lymer, 2014:328; IIA, 2016o:56). GAS enables the internal auditor to extract data from multiple sources (i.e., databases and files) from an organisation's integrated systems in order to conduct detailed analyses of this data (Lin & Wang, 2011:777; Ahmi & Kent, 2013:89). Therefore, this study focused on the use of GAS as a technology-based audit tool, as formulated in section 1.2. Furthermore, the International Auditing and Assurance Standards Board (IAASB), (IAASB, 2015 International Standard on Auditing (ISA) 330 par.A16) also permits the use of CAATs by auditors during the execution of their duties.

Organisations of all types and sizes are facing a growing number of risks that influence the reliability of financial statements and the effectiveness of internal controls and corporate governance practices (Rezaee, 2010:50). The 2009 King Report on Corporate Governance for South Africa (King III Report) requires a company's board of directors (also referred to "those charged with governance duties" in the King IV Report) to oversee the risk management and governance practices of the company, to ensure that the stakeholders' interests are protected, and that the company conducts business in an ethical and transparent manner (Institute of Directors (IOD), 2009:29). This is also emphasised in the King IV Report (IOD, 2016:61). The importance of internal audit, risk management and information technology in a company is repeatedly emphasised in the King III Report: each of these topics has a dedicated chapter included in the King III Report. In addition, internal audit is widely recognised as a key assurance provider on the risks an organisation faces, hence the importance of a sound audit methodology that should now include the use of GAS.

The importance of the assurance that internal audit provides on the control environment that mitigates the risks in an organisation is equally applicable to the banking sector (South Africa 2007a, sec. 90; Bank for International Settlements (BIS), 2012:4). The main objective of the South African Reserve Bank's (Reserve Bank) Bank Supervision Department (the Supervisor) is to promote the security and trustworthiness of banks and the banking system in South Africa (Reserve Bank, n.d. (a)). The Supervisor therefore has an interest in the implementation of sound corporate governance practices as these are important elements of an effective and functional bank, and failure to implement these practices effectively may negatively impact a bank's risk profile (BIS, 2011:21; Reserve Bank, n.d. (a); BIS, 2015a:3) and thus also bring the local industry's reputation into question.

Banks are key role players in the overall health and wealth-generating capacity of a country's economy; it is therefore crucial for a country to have a sound banking system as this will facilitate (and accelerate) economic growth and improve investors' confidence (Makhubela, 2006:6; KPMG, 2012(a):10). The banking industry, like any other business sector or industry, is however not immune to risks and can also run into financial difficulties. This can be seen from the number of bank failures that have occurred locally and internationally (refer to Tables 1.1, 1.2 and 1.3) (Okeahalam, 1998; Makhubela, 2006; Woods, Humphrey, Dowd & Liu, 2009; Chen, Zhang, Xiao & Li, 2011).

A bank failure has negative financial, economic, social and political implications and impacts a country's entire economy (Okeahalam, 1998:29). As Roy Culpeper has remarked: *"Finance is a public good: it is the lifeblood of the economy"* (Culpeper, 2012:384). In the case of bank failures, the greatest impact will be felt by the general public as most bank liabilities are owed to the bank's depositors (Atay, 2006:66; Culpeper, 2012:384). The loss of public confidence in a country's financial system will result in interruptions to transactional processes and losses to creditor counterparts in interbank markets, and this could potentially lead to a systematic cascading of debilitating effects throughout a country's national financial systems, as well as on the international financial systems to which it is linked (Atay, 2006:66; Xafa, 2010:476; Chen, Zhang, Xiao & Li, 2011:1780; KPMG, 2012(b):3).

Today, banking practices are no longer restricted to one country or a single jurisdiction, but are characterised by cross-border transactions in multiple countries under a plethora of different legal and regulatory frameworks, which increases the likelihood of the emergence of a system-wide crisis should there be a loss of public confidence as a result of the failure of a single country's banks (Atay, 2006:66). The international financial crisis that started in 2007 had its roots in stresses experienced by the banking industry that originated in the United States' sub-prime mortgage market (Gilbert, Calitz & Du Plessis, 2009:43; Dombret, 2013:35). Banks in the United States of America (USA) implemented poor lending practices, most notably involving borrowers with poor credit histories. When interest rates spiked this put average household incomes under stress and many of these borrowers defaulted on their repayments. A consequence of this surge in defaults was its negative effect on the profitability and liquidity of the lender banks (Stokes, 2007), the impact of which is still, even today being felt by the USA's economy. Key events of failures of banks and other financial institutions, amongst others, in the USA during the financial crisis are summarised in Table 1.1.

Table 1.1: Key USA events during the financial crisis

DATE	KEY EVENT
14 March 2008	The investment bank Bear Stearns is declared insolvent. JP Morgan Chase agrees to buy Bear Sterns for $236.2 million (Henry, 2009:3; Aubuchon & Wheelock, 2010:395; Dombret, 2013:35).
5 September 2008	The Silver State Bank is taken over by the Federal Regulator which results in $20 million of losses in customer deposits (Edwards, 2008:5; Gordon, 2008).
6 September 2008	Fannie Mae and Freddie Mac receive bailouts from the USA government. These two government-sponsored enterprises play a key role in the USA's housing markets and collectively held or guaranteed about $5.2 trillion of home mortgage debt at the start of their conservatorships (Frame, Fuster, Tracy & Vickery, 2015:2).

DATE	KEY EVENT
14 September 2008	The Bank of America agrees to purchase Merrill Lynch for $50 billion (Anderson, Dash & Sorkin, 2008; Henry, 2009:3).
15 September 2008	The collapse of Lehman Brothers (a 158 year old investment bank) occurs. This is regarded as one of the largest bank failures in the history of the USA. On 16 September 2008, Barclays signs an agreement to purchase the investment banking and capital markets businesses of Lehman Brothers for $1.75 billion (Henry, 2009:3; Shell, 2009; Fernando, May & Megginson, 2012:236; Dombret, 2013:35).
16 September 2008	The USA government extends a two-year loan of $85 billion to the American Insurance Group (AIG) in an effort to prevent the collapse of AIG (Byrnes, 2008; Aubuchon & Wheelock, 2010:395; Dombret, 2013:36).
22 September 2008	The investment banks Goldman Sachs and Morgan Stanley come under regulation of the Federal Reserve Bank (Clark, 2008; Henry, 2009:4; Shen, 2016).
1 January 2007 – 31 March 2010	206 Federally insured banks (commercial banks, savings banks and savings and loan associations) fail, effectively losing $373 billion of bank deposits. Of this $373 billion in recorded losses, the Washington Mutual Bank alone accounted for $211 billion (Goodman & Morgenson, 2008; Read, 2008; Aubuchon & Wheelock, 2010:395).

(Source: own deduction)

Europe was also not able to avoid this international financial crisis, driven as it was by investors losing confidence in the value of securitised mortgages, and five of the United Kingdom's (UK) biggest banks were left with significant liquidity crises. These banks were Northern Rock, Royal Bank of Scotland (RBS), Halifax Bank of Scotland (HBOS), Lloyds TSB and Bradford & Bingley (B&B) (Chen *et al.,* 2011:1779). The main cause of these British banks' failure has been attributed to their exposure to the systemic risk inherent in the sub-prime mortgage market that originated in the USA (Chen *et al.,* 2011:1779). Table 1.2 provides a summary of the key events, amongst others, during the European financial crisis period.

Table 1.2: Key European events during the financial crisis

DATE	KEY EVENT
August 2007	The French bank BNP Paribas initiates a sharp rise in the cost of credit offered to the global mortgage market as a result of the American sub-prime mortgage market crisis.
21 August 2007	The UK sub-prime lenders begin to withdraw mortgages and increase the cost of borrowing for UK homeowners with poor credit histories.
4 September 2007	Inter-bank loans also stopped as banks become reluctant to lend money to each other.
13 September 2007	Northern Rock receives £26 billion worth of financial support from the Bank of England (BoE).
14 September 2007	The share price of Northern Rock drops and distressed depositors start forming queues outside Northern Rock branches to withdraw their money from the bank.
22 February 2008	The UK government announces the nationalisation of Northern Rock.
29 September 2008	B&B receives £18 billion from the government to ease their liquidity problem; the UK government also takes control of £50 billion of B&B's mortgages and loans.
October 2008	The UK government allocates £20 billion to RBS, £11.5 billion to HBOS and £5.5 billion to Lloyds TSB to provide these banks with relief from their financial difficulties.
January 2009	The UK government has to decide whether more financial support is needed to bail out the banks and to restore confidence in their banking system.

(Source: Chen *et al.,* 2011:1783)

The financial crisis in Europe not only had a catastrophic impact on the UK government's financial position, challenging its ability to provide "life-lines" to these distressed banks, but it also negatively affected the reputation of the European banking industry and its economy as a whole.

In addition to the bank failures that were experienced as a result of the global financial crisis of 2007, bank failures and/or bank scandals have also occurred as a result of, amongst others, poor management, ineffective corporate governance, inadequate risk management practices and a lack of the internal controls that should reside in the banks. This is evident in a number of high profile international banking collapses: Bank of Credit and Commerce International collapsed in July 1991 (one of the largest bank failures in Luxembourg at the time); Barings Bank collapsed in February 1995; three large Japanese banks failed in November 1997 (Hokkaido Takushoku Bank, Long-term Credit Bank of Japan, Nippon Credit Bank) and Societe Generale failed in January 2008 (Kanas, 2005:102; Hori, 2006:257; Mawhinney, 2009; Previtali, 2009; Bessis & Maguire, 2011; Canac & Dykman, 2011). The Bank of Credit and Commerce International, at the time of its collapse, had a total asset base of $20 billion and had over 400 offices in 73 countries across the world. Its collapse can largely be attributed to internal irregularities and fraud (Kanas, 2005:102). Barings Bank, one of England's oldest (223 years old at the time), occurred principally because of its failure to implement (or the total absence of) internal controls. In addition, the wilful disregard of segregation-of-duty protocols by one of its traders (Nic Leeson) caused the bank to suffer a loss of £1billion over the space of a few weeks (Mawhinney, 2009:247; Previtali, 2009:25; Bessis & Maguire, 2011:7; Canac & Dykman, 2011:9). The three failed Japanese Banks (Hokkaido Takushoku Bank, Long-term Credit Bank of Japan, Nippon Credit Bank) occurred largely due to poor lending practices and bad loan books (Hori, 2006:257). Societe Generale (one of France's largest banks) failed in 2008 largely because its internal controls were essentially non-existent, or routinely ignored. This made it possible for one of its traders (Jerome Kerviel) to side-step its segregation-of-duties protocols: the bank suffered a loss of €4.9billion as a consequence (Mawhinney, 2009:247; Previtali, 2009:24; Bessis & Maguire, 2011:5; Canac & Dykman, 2011:9).

Additional examples, of historically significant bank failures and/or bank scandals that have occurred in other parts of the world include:

- The liquidation of Glasgow Bank in Scotland was as a result of poor management and fraud. The bank was liquidated on 2 October 1878 with an outstanding capital deficit of £5 190 184 (Lee, 2012b:147).
- The losses experienced at the Bank of China (one of the largest banks in China at the time (October 2001)) were mainly due to poor corporate governance, inadequate risk management practices and a lack of internal controls (Higgins, 2012:1178).
- The failure of the Global Trust Bank of India in July 2004 was mainly attributed to poor operational efficiency, poor corporate governance and a lack of transparency regarding its actual financial position (Bhowmik & Tewari, 2010:42).
- The UBS banking scandal (July 2009) in Switzerland occurred as a result of illegal disclosure of confidential client information of some of its United States-based customers. This resulted in a penalty of $780 million being imposed, in favour of the United States Government (Bondi, 2010:2).
- The Kabul Bank of Afghanistan (February 2010) experienced losses of approximately $900 million as a result of fraud and mismanagement (Rubin & Risen, 2011).

South Africa also has its own history of bank failures, the causes of which include liquidity problems, poor management, poor corporate governance and poor lending practices (most frequently inappropriate real estate loans) (Roux, 2003:44; Makhubela, 2006:114). The collapse of Saambou Bank in 2002, as a result of liquidity problems, left thousands of households in distress as depositors, pensioners and investors discovered that their money was far from secure and largely inaccessible (Steyn, de Beer, Steyn & Schreiner, 2004:76).

Table 1.3 provides an historical perspective of key South African bank failures and banking problems that have occurred over the last 40 years, and identifies the primary causes of each failure.

Table 1.3: History of South African bank failures and their primary causes

BANK	YEAR OF BANK FAILURE	CAUSE OF FAILURE
Clanwilliam Board of Executors	1972	Poorly managed, liquidity problems and loss of depositors' and investors' confidence (Edwards, 2000:80).
UDC Bank	1974	Poorly managed and poor corporate governance (Edwards, 2000:80).
Wesbank	1975	Poorly managed and poor corporate governance (Jones, 1999:213; Edwards, 2000:80).
Trust Bank	1976	Poorly managed and poor corporate governance (Jones, 1999:206; Edwards, 2000:80).
Rondalia Bank	1976	Poorly managed, liquidity problems and loss of depositors' and investors' confidence (Edwards, 2000:81).
Breda Bank	1977	Poorly managed and poor corporate governance (Edwards, 2000:81).
Spes Bona Bank	1977	Poorly managed and poor corporate governance (Edwards, 2000:81).
Concorde Bank	1977	Poorly managed and poor corporate governance (Edwards, 2000:81).
Santam Bank	1978	Poorly managed, liquidity problems and loss of depositors' and investors' confidence (Edwards, 2000:81).
Merca Bank	1978	Poorly managed and liquidity problems (Edwards, 2000:81).
Rand Bank	1979	Poorly managed and liquidity problems (Edwards, 2000:81).

BANK	YEAR OF BANK FAILURE	CAUSE OF FAILURE
Nedbank	1985	Poorly managed and liquidity problems (Edwards, 2000:81).
Perm	1988	Poorly managed and liquidity problems (Edwards, 2000:81).
Bankorp	1990	Poorly managed and liquidity problems (Edwards, 2000:81; Gordin, 2007).
Alpha Bank	1990	High level of fraud (Okeahalam, 1998:36; Edwards, 2000:81).
Cape Investment Bank	1991	Fraud and liquidity problems (Okeahalam, 1998:36; Edwards, 2000:81).
Pretoria Bank	1991	Poorly managed (Okeahalam, 1998:36; Edwards, 2000:81).
Boland Bank	1992	Poorly managed and poor corporate governance (Edwards, 2000:81).
Sechold Bank	1993	Liquidity problems and loss of depositors' and investors' confidence (Okeahalam, 1998:36; Edwards, 2000:81).
Prima Bank	1994	Liquidity problems as a result of non-performing loans (Okeahalam, 1998:36; Edwards, 2000:81; Makhubela, 2006:74).
African Bank (the new registered entity called African Bank Limited opened its doors on 4 April 2016), (African Bank, 2016).	1995	Poorly managed and liquidity problems (Okeahalam, 1998:37; Edwards, 2000:81; Makhubela, 2006:79).

BANK	YEAR OF BANK FAILURE	CAUSE OF FAILURE
Community Bank	1996	Poorly managed and liquidity problems (Okeahalam, 1998:37; Edwards, 2000:81; Makhubela, 2006:82).
Islamic Bank of South Africa	1997	Poorly managed and improper accounting and management systems (Okeahalam, 1998:37; Makhubela, 2006:86).
New Republic Bank	1999	Liquidity problems as a result of non-performing loans (Edwards, 2000:81; Makhubela, 2006:88; Van Heerden & Heymans, 2013:730).
FBC Fidelity Bank	1999	Liquidity problems and loss of depositors' and investors' confidence (Makhubela, 2006:91; Cronje, 2007:11; Van Heerden & Heymans, 2013:730).
Regal Treasury Private Bank	2001	Poorly managed and loss of depositors' and investors' confidence resulting in depositors withdrawing all their funds from the bank (Roux, 2003:50; Makhubela, 2006:94; Cronje, 2007:11).
Saambou Bank	2002	Poorly managed: liquidity risk and credit risk unsustainably high due to poor lending practices (Roux, 2003:68; Makhubela, 2006:97; Gidlow, 2008:32).
UniFer	2002	Poorly managed and poor corporate governance (Faure, 2003; Roux, 2003:59).

BANK	YEAR OF BANK FAILURE	CAUSE OF FAILURE
BOE Limited	2002	Liquidity problems and loss of depositors' and investors' confidence resulting in depositors withdrawing all their funds from the bank (Jones, 2003:248; Gidlow, 2008:32).
African Bank (the new registered entity called African Bank Limited opened its doors on 4 April 2016), (African Bank, 2016).	2014	Loss of depositors' and investors' confidence (refer to the discussion to follow) (Bonorchis & Spillane, 2014; Radebe, 2014:1).

(Source: own deduction)

The notion that organisations and/or banks are "too big to fail" did not hold true, as can be seen from the numerous international and local bank failures and/or bank scandals (as previously discussed) that have occurred in the economic history of the global banking industry. The possibility of bank failures remains a reality of everyday business, and individual banks need to implement effective risk management and governance practices in order to ensure a sound and effective global banking system. Recent examples of events that have had an adverse impact on the local banking industry, as well as on depositors' and investors' confidence, was the R125 million fine that was imposed on South Africa's four largest banks by the Reserve Bank as a result of the inadequacy of their anti-money laundering controls in April 2014 (Barry, 2014:35). An additional example is the R17 billion bailout given to African Bank (to cover its bad debt), by the Reserve Bank after African Bank's share price plummeted more than 90% in 2 days in August 2014. This was mainly as a result of depositors and investors having lost confidence in African Bank's ability to run a sustainable business, which in turn was as a result of their bad loan book comprising predominantly unsecured loans (Radebe, 2014:1). Furthermore, reviewing the information in Table 1.3, it should be obvious that it is the confidence of the depositors and investors, and the effective protection of their interests, that provides the foundation for a sound national banking system, and this is what needs to be ensured through, amongst others, effective banking practices and good corporate governance. Such measures should be designed to prevent a system-wide crisis, which then contributes to ensuring the overall health of a country's economy. Public trust and confidence in a banking system is dependent on the implementation of effective corporate governance practices in each and every bank, which then collectively ensures the proper functioning of the banking industry and the economy as a whole (KPMG, 2012(a):2; BIS, 2015a:3). Ensuring that the internal audit function performs according to its mandate, as stipulated in the Statement of the Internal Auditors Responsibilities, is critical to the effective management of a bank, particularly with regard to meaningful risk management, control and governance practices (IIA, 2012a:21).

These local and international bank failures have resulted in the surviving banks' boards of directors and senior management placing more reliance on their internal audit functions in their on-going efforts to improve the internal controls and governance of their banks (Deloitte, 2009:5). The areas of effective governance and of internal controls in particular remain a priority for banks' boards of directors and senior management (Senior Supervisors Group, 2009:22). Regulation 48 of the South African Banks Act, 20 of 2007 (Banks Act), *inter alia*, states that *… "the internal audit function shall in writing inform the Registrar of Banks of any bank matters which may impose a threat to the bank's ability to continue as a going concern or [of] any threats relating to the protection of depositors' money or any non-compliance with the principles of sound governance including any deviation relating to the bank's internal controls"* (South Africa 2007a, sec. 90).

Similarly, the King III Report requires a company's board of directors or its committees to ensure that the effectiveness of the internal controls is evaluated by an effective internal audit function (IOD, 2009:31). This is also emphasised in the King IV Report (IOD, 2016:69). The Basel Committee on Banking Supervision (the Committee) issued an international guidance document regarding the effectiveness of internal audit functions in banks. This resulted in increased pressure on banks' boards of directors and senior management to demonstrate that their internal audit functions are, and continue to be effective in the performance of their duties (BIS, 2012:2). Standard 2130 *Control*, issued by the International Standard for the Professional Practice of Internal Auditing requires the internal audit function to assist an organisation to maintain effective controls by evaluating the controls' effectiveness and efficiency and by promoting continuous improvement (IIA, 2012a:12).

The IIA (IIA, 2012a:21) defines an internal audit function as: *"A department, division, team of consultants, or other practitioner(s) that provides independent, objective assurance and consulting services designed to add value and improve an organisation's operations. The internal audit activity* ***helps an organisation accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of governance, risk management and control processes"*** [own emphasis]. The internal audit function can either be in-house, outsourced or co-sourced. An in-house internal audit function is a department or division that resides entirely inside an organisation's corporate structure: audits are therefore performed by internal auditors who are employees of that organisation (Chadwick, 2000:88; Desai, Gerard & Tripathy, 2008:5). An outsourced internal audit function refers to the employment of an outside organisation, where audits are performed by a team of external consultants (Ahlawat & Jordan Lowe, 2004:147; Desai, Gerard & Tripathy, 2008:5). A co-sourcing agreement consists of a combination of in-house internal auditors and external consultants (Desai, Gerard & Tripathy, 2008:5). The in-house internal audit function will normally make use of external consultants where a specific audit engagement requires specialist knowledge and skills not present within the organisation (Desai, Gerard & Tripathy, 2008:5).

According to both the King III and King IV Reports (IOD, 2009:93; IOD, 2016:70), the internal audit function is responsible to the board of directors, or to its committees, or both, for the following:

- the evaluation of the company's governance processes including a review of its ethics;

- the performance of an objective evaluation of the effectiveness of risk management and the internal controls structure within the company;
- the analysis and evaluation of business processes through a systematic, disciplined approach, to provide a source of information identifying instances of fraud and irregularities; and
- the promotion of continuous improvement within the company's business operations.

The King III Report requires, furthermore, that the board of directors report on the overall effectiveness of the company's internal controls: this effectiveness report must be disclosed in the integrated report and based on an assessment from the company's internal audit function (IOD, 2009:95). The King IV Report also draws attention to this responsibility of the board of directors (IOD, 2016:70). The most recent COSO internal control framework reiterates the governing accountability of the board of directors in this regard. It defines internal control as: *"… a process, effected by an entity's board of directors, management, and other personnel, designed to provide reasonable assurance regarding the achievement of objectives relating to operations, reporting, and compliance"* (COSO, 2013:1). The internal auditors must therefore decide how much evidence should be gathered in order to express a *reliable* opinion as to the effectiveness of the organisation's internal control environment, its governance and its risk management practices (Applegate, 2010:19). The importance of the internal audit opinion is also demonstrated by the *reliance* that is placed on it by the Supervisor, and the bank's board of directors, audit committee, senior management, and other stakeholders (South Africa, 2007a, sec.48 (v)(i); IOD, 2009:95-100; Rezaee, 2010:50; BIS, 2012:15; PwC, 2012:18; IOD, 2016:70). The external auditor might also decide to place reliance on the results of the internal audit function's work, citing it as supporting evidence for the conclusions reached (IAASB, 2015 ISA 610 par.15).

Standard 2450, *Overall Opinions,* states that the overall internal audit opinion must be supported by sufficient, reliable, relevant and useful evidence, and must consider the expectations of senior management, the board of directors and other stakeholders (IIA, 2012a:17). If an auditor's opinion is questioned, outsiders should be able to evaluate the audit evidence to determine whether the auditor gathered sufficient, reliable, relevant and useful evidence consistent with what another reasonable, prudent and competent auditor would have gathered (Stuart, 2012:140). To this end, business today is characterised by significantly increased and still increasing volumes of data and transactions compared to earlier periods in economic history (KPMG, 2012b:9; EY, 2013b:6; Jackson, 2013a:35; PwC, 2014:25).

This increase in the number of transactions and the volume of client data has had a significant and direct impact on the internal auditing profession. Internal auditors had to revisit the manner in which they collect audit evidence in order to achieve the predetermined engagement objectives in an efficient manner. The internal auditor can collect audit evidence for the purpose of evaluating the effectiveness of internal controls in one of the following three ways:

- full population testing (i.e., a 100 percent examination of all items in the population with the use of technology-based tools such as GAS);
- judgmental selection of specific items (i.e., the inclusion of specific items from the population based on pre-determined criteria); and
- audit sampling (audit sampling techniques employed by internal auditors can be classified as either statistical or non-statistical) (Maingot & Quon, 2009:218; Urbancic, 2009:3; Aghili, 2011:21; AICPA, 2012:23; Smidt, 2014:85; IAASB, 2015 ISA 530 par.5 (g)).

These methods of collecting audit evidence can all be conducted with the use of GAS. The functionality of GAS, addresses population analysis to enable focused risk-based audit planning, 100 percent examination of all items in the population, the selection of items with specific characteristics, and statistical tools and sampling techniques, amongst others (Coderre, 2009:5; IIA, 2011:6; AICPA, 2012:3; Ahmi & Kent, 2013:89; Olasanmi, 2013:69; Tumi, 2014:3; IAASB, 2015 ISA 500 par.A53). The different functions of GAS will be discussed in more detail in Chapter 3. Importantly, the IIA Research Foundation (2010a:27), in their 2010 Common Body of Knowledge (CBOK) report on the *Core Competencies for today's Internal Auditor*, predicted that the use of technology-based tools by internal audit functions in the following five years was going to increase and GAS was also ranked as one of the top 5 audit tools and techniques that would be utilised in the coming years. The accuracy of this prediction is unsurprisingly indicative of the pace of change: there is already an intensification of stakeholder expectations of their internal audit functions. Specifically, internal audit functions are expected to broaden their audit coverage in a business landscape that is characterised by significantly increasing volumes of data, and the banking industry is probably leading the way (PwC, 2014:2; PwC, 2015:17). These rising expectations have already been officially recognised by the IIA in their global report, *The pulse of the profession - Enhancing value through collaboration: A call to action* (IIA, 2014:1). Perversely, perhaps, the IIA's Research Foundation (2015a:7), in their 2015 (CBOK) report on *Staying a step ahead: Internal audit's use of technology*, indicated that globally the use and/or adoption of technology-based tools by internal audit functions is still at a relatively low level.

Given the extremely large number of transactions processed in a bank, and the risks involved, the achievement of broader audit coverage with regard to a bank's risk universe should realistically be possible, but only with the adoption and optimal use of GAS. In addition, GAS enables the internal auditor to test an entire population, compared to the traditional sampling approach, with its additional risk of not always being representative of the audit population. In comparison, full population testing should increase the level of reliance that can be placed on the auditor's opinion relative to the reliability of the result when only a portion of the population was subject to the internal auditor's assessment. Although the benefits of using GAS in the execution of internal audits are well known, there are varying levels of maturity (the extent and effectiveness of use) in the use of these tools by different internal audit functions. The focus of this study is to assess the extent and effectiveness of the use of GAS as a means of gathering audit evidence for the evaluation of the effectiveness of a bank's risk management, governance and internal controls. A number of maturity assessment frameworks have been developed to measure the extent and effectiveness of the use of data analytics in a number of industries. Internal audit's maturity in the use of GAS can be assessed according to these data analytics maturity frameworks. This study however makes use of an analysis of the following frameworks and scales to develop a specific benchmark for the assessment of the current levels of maturity of use of GAS by internal audit functions in banks:

- the Audit Command Language's (ACL) audit analytic capability "maturity" model (ACL, 2013:4);
- Deloitte's maturity model for internal audit analytics (Deloitte, 2013:5);
- EY's internal audit analytics maturity model (EY, 2014:4);
- PwC's data analytics maturity scale (PwC, 2013b:2);
- KPMG's data analytics maturity assessment (KPMG, 2013:5);
- IIA's data analytics maturity model framework (IIA, 2016o:40); and
- IIA's data analysis usage maturity levels (IIA, 2011:21).

The analysis and comparison of these frameworks and/or models will be discussed in detail in sections 1.4.4 and 3.7 and their similarities will be collated in order to identify "universal" benchmark criteria. The common criteria drawn from these leading practice frameworks then informed the benchmark that was developed for the empirical assessment of the use of GAS by internal audit functions in the South African banking industry. All but one of the above-mentioned data analytic maturity frameworks uses a 5-level maturity assessment scale; the exception, KPMG's data analytic maturity assessment, uses a 4-level maturity assessment scale. The objective of and rationale for developing these benchmark criteria will be discussed in more detail in section 1.2.

1.2 PROBLEM STATEMENT AND RESEARCH OBJECTIVES

Section 1.1 made reference to the important role of banks in national and international economies. The impact of the international financial crisis on the world economy, with numerous examples of recent international and local bank failures, was also highlighted.

The mandate of the internal audit function (required in terms of the Standards and pertinent legislation), was defined in section 1.1. It places a great responsibility on that function to evaluate the effectiveness of governance, risk management and control processes in order to express reliable audit opinions that give a true reflection of the soundness of a bank's operations. It should be remembered that, all else being equal, the internal auditor's opinion on the effectiveness of the control environment of a bank provides reasonable assurance that depositors' and investors' money is secure. In addition, an effective internal control environment may possibly reduce the risk of a bank failure occurring. This evaluation of the effectiveness of governance, risk management and control processes must be supported by "sufficient, reliable, relevant, and useful information" that is in line with the engagement's objectives (IIA, 2012a:14, Standard 2310). As a result, the IIA (as mentioned in section 1.1) requires internal auditors to apply *due professional care* in the execution of their responsibilities.

The use of GAS, amongst other tools, is now required to support the obligation to exercise due professional care. In spite of this requirement, Smidt (2014:152), in his study on the use of sampling by internal audit functions in the South African banking industry, found that 90% of respondents indicated that the use of GAS "could be utilised more frequently" within their respective departments. In addition, only 22.2% of these respondents indicated that the use of technology-based tools was mandatory in their internal audit units (Smidt, 2014:152). Furthermore, despite the availability of technology-based tools to the internal audit function for testing the effectiveness of controls, current research still indicates that these are not being utilised to anywhere near their full potential (also refer to section 3.5) (EY, 2012:12; PwC, 2013a:10; Mahzan & Lymer, 2014:328). This is also confirmed by the IIA's Research Foundation (2015a:7) in their 2015 (CBOK) report entitled *Staying a step ahead: Internal audit's use of technology*, which indicated that globally the use and/or adoption of technology-based tools by internal audit functions is still at a relatively low level (as mentioned in section 1.1). This low use of technology-based tools by internal auditors could have an adverse impact on the effectiveness and efficiency of these (recalcitrant) internal audit functions (Asgari, Soleimanian & Goli, 2013:684).

With reference to the background provided, the **problem statement** defined for this study is as follows:

> *The limited use of technology-based tools and techniques (more specifically the use of GAS) by internal audit functions in the locally controlled South African banking industry (as mentioned in section 1.1) might lead to engagement objectives not being achieved. It may further result in various*

stakeholders' expectations not being addressed in an efficient manner, and more importantly, might lead to technically logical but essentially unreliable (or worst case irrelevant) audit opinions being expressed regarding the effectiveness and soundness of a bank's operations. This risk is increasing alongside the significant increases in volumes of the underlying audit populations that reside within a bank. The research problem that informs this thesis is therefore to assess the maturity of the use of GAS by internal audit functions in the locally controlled South African banking industry.

Furthermore, the utilisation of inappropriate audit tools and techniques can also result in significant financial losses to banks and their various stakeholders. It could additionally lead to a loss of confidence in the internal audit profession and a diminution of the perceived value of its services. This, in turn, exposes the profession to accusations of negligence, which could be followed by onerous legal consequences for the audit firm and/or the individual internal auditors conducting the internal audit engagement. Banks face a myriad of risks as they process millions of transactions daily, generally in electronic format, through their individual and often unique integrated electronic systems (EY, 2013a;12). Against this background the internal auditors have to collect meaningful and persuasive audit evidence in order to form reliable audit opinions. This exposes the internal audit profession, as well as the individual internal auditors, (and ultimately a bank's board of directors that appointed them), to high levels of risk.

Given the already elevated and increasing volumes of data and transactions that form part of the day-to-day business activities of a bank, and the high levels of personal and professional risk faced by a bank's board of directors, management and its internal auditors, investigating the problem statement presented earlier will be guided by the following three specific **research objectives**:

- *to measure the existing practices of internal audit functions in the locally controlled South African banking industry regarding the use of GAS, against a benchmark developed from recognised data analytic maturity models, in order to assess the current maturity levels of the locally controlled South African banks in the use of this software for tests of controls;*

- *to explore and identify the purposes for which GAS is presently being used by these internal audit functions; and*
- *to develop recommendations that may assist internal audit functions in the locally controlled South African banking industry to reach their desired maturity levels, using the benchmark developed earlier.*

1.3 DELIMITATION OF THE STUDY

This study has certain limitations relating to its context and its constructs. Firstly it is limited to in-house internal audit functions within the South African banking industry. All *locally controlled* banks that are registered with the Reserve Bank and that are authorised to conduct the business of a bank are included in the study. Foreign banks' representative offices have been excluded from the study as these representative offices are prohibited by the Banks Act from conducting the business of a bank in South Africa (South Africa, 2007b, sec.34(4)). Mutual banks are also excluded as these banks have fully outsourced their internal audit functions. Branches of foreign banks and foreign controlled banks are also excluded as these international banks have in-house internal audit functions that usually perform their duties according to the legal and administrative frameworks of their home countries. In addition, they are not locally owned or controlled.

Secondly, the study is focused on the use of technology-based tools by *internal auditors* in the South African banking industry. This then excludes the technology-based tools employed by external auditors in the South African banks. The study is further limited to technology-based tools used by internal auditors when performing population analysis in efforts to identify high risk areas that warrant further emphasis. An additional limitation obtains in that it investigates the internal auditor's conduct in performing *tests of controls,* but does not attempt to explore the use of technology-based tools when performing tests of details or any other form of investigation. The IIA defines technology-based tools (refer to section 1.1) as: *"Any automated audit tool, such as GAS, test data generators, computerised audit programs, specialised audit utilities, and computer-assisted audit techniques (CAATs)"* (IIA, 2012a:23). The study's final limitation is thus that it explores the use of GAS alone, and does not attempt to explore the use of the other technology-based tools and techniques mentioned in the IIA's definition.

1.4 RESEARCH METHODOLOGY

1.4.1 Introduction

The term "research" embraces an extensive family of approaches to research design and associated methodologies, as has been stated in numerous publications on research (Mouton, 2001:107; Salkind, 2009:13; Bryman & Bell, 2011:150; Creswell & Plano Clark, 2011:2; Saunders, Lewis & Thornhill, 2012:161; Leedy & Ormrod, 2013:184; James & Slater, 2014:59). These publications employ a diverse range of terminology pertaining to research, including:

- qualitative research;
- quantitative research;
- historical research;
- descriptive research;
- mixed method research;
- multiple methods research;
- survey research; and
- experimental and clinical research.

For the purposes of this study (which was limited to a literature-based investigation and an empirical research component), the term "research" (as understood by various authoritative sources) is defined as: *the systematic and logical process of collecting, analysing and interpreting information, whether collected through examining previous studies (literature review), or by collecting new data (empirical review), with the objective of understanding a specific field of study* (Burns & Burns, 2008:5; Saunders *et al.,* 2012:5; Leedy & Ormrod, 2013:2). This study makes use of both of these research approaches.

A literature review was performed to gain an understanding of the use and applicability of GAS within the internal audit profession. Mouton (2001:91) points out that a literature review should be well structured so as to enable the reader to understand and follow the sequential and logical flow of information and ideas. The literature review assisted in identifying the already recognised strengths and weaknesses of the currently used data analytic maturity models; against these the existing practices governing the use of GAS were measured.

The literature review was followed by empirical research. The empirical research collected new evidence on the use of GAS by internal audit functions when performing tests of controls in the South African banking industry. This study was guided by the specific research objectives outlined in section 1.2. This study is a continuation of the research done on the use of sampling within internal audit functions in the South African banking industry, which was conducted for the degree Magister in Auditing in the Centre for Accounting, in the Faculty of Economic and Management Sciences at the University of the Free State. The empirical research questionnaire used in that study generated a 90% response rate from the universe of the 10 locally controlled banks' internal audit functions. All the participating banks' heads of internal audit were then provided with the results of that study.

This section (1.4) addresses the research design and its theoretical framework and discusses the parameters guiding the selection of participants. The design of the research instrument is also discussed and an overview of the reliability and validity of the research instrument used in this study is also presented. The section also provides a discussion of the data collection and analysis processes and includes a description of the ethical aspects of this research that were addressed in order to ensure that this study was conducted in compliance with the University of the Free State's rules of ethical research, and those generally accepted internationally.

1.4.2 Theoretical framework

As far as could be determined there are no existing theories specifically addressing the basis of the relationship associated with internal audit and the provision of professional services by the internal audit function. There are however numerous theories related specifically to external audit and accounting functions. The most widely recognised of these include:

- Limperg's theory of inspired confidence;
- the information theory;
- the insurance theory;
- the agency theory;
- the assurance theory;
- the positive accounting theory;
- legitimacy theory; and
- stewardship theory (Jensen & Meckling, 1976:308; Watts & Zimmerman, 1978:112; Donaldson & Davis, 1991:51; Carmichael, 2004:128; Sijpesteijn, 2011:12-19).

As a result of the absence of established theories specific to internal audit, Swinkels (2012) conducted a doctoral study on the theoretical foundations of internal audit in relation to the nature and use of control systems in Dutch public listed firms. According to Swinkels (2012:71) internal audit, as an assurance function for an organisation, is expected to deliver services using approaches guided by assumptions regarding the nature of the firm; this is now referred to as the *Theory of the firm*. The *Theory of the firm* emerged from the interaction of three different views of business relationships: agency theory; transaction cost economics, and resource and knowledge-based theory.

Next, each of these views is briefly described:

- **Agency theory**: Refers to the principal-agent relationship where the owners (principals) of companies entrust the handling of their interests to management (agents). Because of a difference in motives between principals and their agents, a lack of trust may arise. Consequently, principals may need to implement control measures in order to ensure their interests are protected and effectively managed (Jensen & Meckling, 1976:308).
- **Transaction cost economics**: Refers to a contractual or transactional relationship between parties in which each party expects something from the other

(i.e., a mutually beneficial relationship). Furthermore, it analyses the prerequisites needed to create the most economic, value-preserving governance structure capable of imparting order in an effort to mitigate conflict and to realise a mutual gain for each party involved (Williamson, 2002:174).

- **Resource and knowledge-based**: This view refers to the competitive advantage a firm has as a result of its access to valuable resources (Wernerfelt, 1984:172). Swinkels (2012:93) points out that a proper system of control is one of the valuable resources that may lead an organisation to enjoy a competitive advantage over its competitors compared to an organisation with an ineffective control environment.

The role and/or the purpose of the internal audit function (as mentioned in section 1.1) implicitly embodied in each of the views associated with the *Theory of the firm* are described in Table 1.4.

Table 1.4: Linkage between internal audit and the views of the theory of the firm

VIEWS OF THE THEORY OF THE FIRM	LINK TO INTERNAL AUDIT
Agency theory: principals may need to implement ***control measures*** in order to ensure their interests are protected and effectively managed.	The internal audit function's main purpose (as mentioned in section 1.1) is to provide an independent assurance and consulting service to an organisation's senior management, and to the board of directors and/or its audit committee, regarding the adequacy and effectiveness of an organisation's risk management, ***control*** and governance processes.
Transaction cost economics: analyses the options in order to find the most economic, value-preserving ***governance structure*** to impart order	Internal audit's main responsibility is to provide an organisation's board of directors and/or its various committees, with an assessment of the effectiveness

VIEWS OF THE THEORY OF THE FIRM	LINK TO INTERNAL AUDIT
in an effort to mitigate conflict and to realise a mutual gain for each party involved.	of the organisation's risk management, controls, and ***governance practices***, in order to achieve the organisation's various objectives (IOD, 2009:93; BIS, 2012:12; Financial Stability Board (FSB), 2013:G44-G58; IOD, 2016:70).
Resource- and knowledge-based: a proper ***system of control*** is one of the valuable resources that may lead an organisation to have a real advantage over its competitors.	The internal audit function's main purpose (as mentioned in section 1.1) is to provide an independent assurance and consulting service to an organisation's senior management, and to the board of directors and/or its audit committee, regarding the adequacy and effectiveness of an organisation's risk management, ***control*** and governance processes. Consequently, the internal audit function can be viewed as a valuable resource (i.e. contributing to efficiency and effectiveness) as part of the overall control system of an organisation (Swinkels, 2012:93).

(Source: own deduction)

Following the linking of internal audit's "deliverables" to the *Theory of the firm* as outlined in Table 1.4, together with the research objectives of this study as outlined in section 1.2, it was decided that this study should take the *Theory of the firm* as its foundation and starting point. In addition, any research in the field of internal audit must also take cognisance of the guidance afforded by the frameworks and standards published by the Institute of Internal Auditors. Any research in the field of internal audit should therefore be conducted within the parameters laid down by the IIA.

1.4.3 Research design

The research design for this study employed a mixed method approach. Bryman and Bell (2011:628) define a mixed method approach as a combination of quantitative and qualitative research in the same project. The research is pragmatic in nature, a characteristic which is usually associated with the use of a mixed method research approach (Saunders *et al.,* 2012:130; Creswell & Plano Clark, 2011:41). The pragmatic design element focuses on the intended consequences of research, with primary importance resting on the research question or the research objective: achieving the objective usually requires the use of multiple methods of data collection (Creswell & Plano Clark, 2011:41). Creswell and Plano Clark (2011:190) point out that mixed method research should include at least one quantitative method and one qualitative method of data collection. The primary method of data collection used in this study was by means of a structured questionnaire (quantitative method). The structured questionnaire also gathered additional qualitative data through the use of a limited number of open ended questions. The questionnaire was then followed up with semi-structured telephonic interviews, but only in cases where further clarity was sought from the respondents (qualitative).

Quantitative research produces numerical data that can be collected through the use of questionnaires (Saunders *et al.,* 2012:161). A structured, self-administered questionnaire was therefore used to collect the numerical data, and this was followed up with semi-structured telephonic interviews (only in cases where further clarity was sought for questionnaire responses that were unclear) for the collection of qualitative data. Qualitative research produces non-numerical data that is usually collected through interviews (Saunders *et al.,* 2012:161). The qualitative data provided additional insight regarding the current frequency of use (i.e., level of maturity) of GAS, and the reasons for including GAS in their respective audit methodologies. The structured questionnaire was mainly used to collect numerical data in order to establish and describe the current levels of maturity of the use of GAS by in-house internal audit functions within the South African banking industry. The questionnaire further assisted the researcher to identify the audit phases where GAS is used most frequently, namely:

- the scoping and planning phase;
- the fieldwork (testing) phase; and/or
- the reporting phase.

1.4.4 Design of the research instrument

The research objectives mentioned in section 1.2 were used as the starting point for developing the data analytics maturity framework, as well as for the questionnaire that was used in this study. The questionnaire was developed using the measurement and/or benchmark criteria that were identified in the data analytics maturity frameworks. It was designed to allow for efficient completion thereof in order to avoid imposing too much time upon the Chief Audit Executives' (CAE's) busy schedules. The design of the data analytics maturity framework and the questionnaire were conducted in a systematic and sequential manner. The data analytics maturity framework was first developed and this was followed by the design of the questionnaire. These steps are briefly discussed next.

1.4.4.1 Design of the data analytics maturity framework

Step 1: To determine how many levels of maturity the proposed data analytics maturity framework should have.

In order to determine the number of levels to be used in the data analytics maturity framework, a thorough review of the existing literature on data analytics maturity frameworks for internal audit functions was conducted. As far as could be established, there are seven existing data analytics maturity frameworks specifically developed for internal audit functions (refer to section 1.1). Each of these data analytics maturity frameworks was analysed and it was established that five of the seven frameworks (IIA, 2011:21; ACL, 2013:4; Deloitte, 2013:5; EY, 2014:4; IIA, 2016o:40) had five levels of maturity. The data analytics maturity scale developed by PwC (2013b:2) has six levels and the data analytics maturity assessment developed by KPMG (2013:5) uses four levels of maturity. It is clear that the majority of the existing data analytics frameworks use five levels of maturity. However prior to making the final decision as to how many levels of maturity would be used for this study it was important to identify what made each level unique on the continuum of the different levels of maturity. Section 3.7 provides a detailed breakdown of the characteristics for each level of maturity. An important fact that emerged from reviewing the existing data analytics maturity frameworks was that, irrespective of the number of levels of maturity used in a specific framework, at their most basic or introductory levels (i.e., levels 0 – 2) the capabilities of internal audit functions with respect to their use of GAS to conduct data analysis are either non-existent or at best “limited” and as a result the frequency of use is also low. On the other hand, levels of maturity at the highest end of the continuum (i.e., levels 4 – 5) indicate internal audit functions that have well-established and implemented capabilities in the use of GAS and data analytics, to the extent that continuous auditing and continuous monitoring capabilities are in place and operational. For the purpose of this study it was decided to use six levels of maturity, with the first (lowest) level, “level 0”, indicating an internal audit function that does not have any capabilities in the use of GAS to conduct data analytics. The highest (most mature) level of maturity used for this study, “level 5”, indicates an internal audit function that is well established in its use of GAS and has continuous auditing and continuous monitoring capabilities in place. An internal audit function operating at maturity level 5 should also be using the results of the data analytics to identify trends and future risk events. Such an internal audit function should then be in a position to provide its stakeholders with meaningful feedback from three key perspectives, namely historical (hindsight), current (insight regarding the current control environment) and future (foresight) (also refer to section 3.7).

Step 2: To identify measurement or benchmark criteria to be used in assessing each internal audit function’s level of maturity in the use of GAS to conduct data analysis.

Each of the seven existing data analytics maturity frameworks (as mentioned earlier) was analysed and the distinct and universal benchmark criteria for each level of maturity were then identified and collated and used in the data analytics maturity framework used for this study. In addition, a review of specific internal auditing literature dealing with the use of data analytics maturity frameworks further indicated that each level of maturity should be assessed in terms of three important aspects, namely: **people**, **process** and **technology** (ACL, 2013:6; Deloitte, 2013:5; KPMG, 2013:11; PwC, 2013b:7; Coderre, 2015:40; IIA, 2016o:49). In other words, the overall maturity assessment should be a collective view of the individual maturities of all three of these aspects (each of these aspects will be discussed in section 3.7). As a result, the data analytics maturity framework used in this study also incorporates each of these aspects on each of the six levels of the maturity framework. The complete data analytics maturity framework used in this study is included as Annexure B.

1.4.4.2 Design of the questionnaire

Step 3: The identification of studies that used questionnaires to explore the use of CAATs and GAS by auditors.

As mentioned in section 1.4.3, the primary method of data collection for this study was through the use of a structured, self-administered questionnaire. Table 1.5 provides a summary of important studies, amongst others, that have used questionnaires to successfully explore the use of CAATs and GAS by auditors.

Table 1.5: Summary of some major studies that used questionnaires to explore the use of CAATs and GAS by auditors

YEAR OF STUDY	AUTHOR/S	TITLE OF STUDY	COUNTRY OF STUDY	TARGET GROUP
2008	Mahzan and Lymer	Adoption of Computer Assisted Audit Tools and Techniques (CAATTs) by Internal Auditors: Current issues in the UK	UK	Internal Auditors

YEAR OF STUDY	AUTHOR/S	TITLE OF STUDY	COUNTRY OF STUDY	TARGET GROUP
2009	Janvrin, Bierstaker and Lowe	An investigation of factors influencing the use of computer-related audit procedures	USA	External Auditors
2012	AuditNet	2012 Survey Report on Data Analysis Audit Software	USA	Internal Auditors
2012	Ahmi	Adoption of Generalised Audit Software (GAS) by External Auditors in the UK	UK	External Auditors
2015	Pedrosa, Costa and Laureano	Use of information technology on statutory auditors' work: New profiles beyond Spreadsheets users	Portugal	External Auditors
2015	Protiviti	Changing trends in internal audit and advanced analytics	USA	Internal Auditors

YEAR OF STUDY	AUTHOR/S	TITLE OF STUDY	COUNTRY OF STUDY	TARGET GROUP
2015	Shamsuddin, Rajasharen, Maran, Ameer and Mathu	Factors influencing usage level of computer assisted audit techniques (CAATs) by internal auditors in Malaysia	Malaysia	Internal Auditors
2016	IIA	Data Analytics: Elevating Internal Audit's value	Global study	Internal Audit

(Source: own deduction)

All the studies mentioned in Table 1.5 produced valid and reliable results through the use of questionnaires. It was therefore decided to also make use of a questionnaire for the purpose of this study. Bradburn, Sudman and Wansink (2004:23) also suggest that a researcher should identify similar studies as they can provide guidance in designing a questionnaire. Consequently, some of the questions used in the mentioned studies were used as a collective starting point in developing the questions that were designed specifically to address this study's research objectives.

Step 4: Developing the questions for inclusion in the current questionnaire.

When developing the questions for use in this study two important aspects had to be considered. Firstly, each question had to be uniquely designed to ensure that it addressed the specific characteristics of each level of maturity defined in the data analytics maturity framework (refer to Annexure B). In other words, the questions had to be formulated to address all three aspects of maturity, namely **people**, **process** and **technology**, as highlighted in step 2. The questionnaire was therefore designed to specifically measure each level of maturity in terms of the following:

- the ability of internal audit team members to embrace data analytics (i.e., the **people** aspect of assessing maturity in the use of GAS);
- the **processes** in place that support and enable the use of GAS; and
- the **technology** platform that enables the conduct of data analytics.

The second important consideration guiding the designing of the questions used in this study was the fact that each question had to address the research objectives that had been defined for this study (refer to section 1.2). The final form of the questionnaire used in this study is included as Annexure C.

1.4.5 Reliability and validity of the research instrument

The success of this (and any) study depends on the respondents' understanding and correct interpretation of the questions posed. The questionnaire was therefore distributed to a pilot group prior to being sent to the full database of potential respondents. The pilot group comprised internal audit practitioners, information systems auditors, academic researchers and certified data analysts on the use of GAS to ensure that the questions posed were clear and would generate usable responses. These test respondents were chosen because of their competence in the way GAS is employed by internal audit functions, as well as for their familiarity with the parameters of academic research. The pilot group consisted of four Certified Internal Auditors (CIAs), two Chartered Accountants (CA (SA)), three Certified Information Systems Auditors (CISA) and two ACL Certified Data Analysts (ACDA), a total membership of eleven. One member of the pilot group conducts training for the IIA in North America and has 30 years of experience in the use of GAS and data analytics as employed by internal auditors. The research instrument was then modified on the basis of the feedback received from the pilot group. In addition to addressing the specifics of GAS usage, the questionnaire was also drafted within the wider context of the most popular and well-recognised internal audit data analytics maturity frameworks (identified in section 1.2).

A final preparatory step involved consulting a professional statistician (a specialist in the use of questionnaires and their interpretation) regarding the validity, reliability and quality of the questionnaire's probable responses. This was done to ensure that the data to be collected would be usable and would lead to meaningful results that could be analysed through the use of descriptive statistics.

The questionnaire was then finalised for distribution.

In addition to these pre-distribution efforts to ensure a scientifically meaningful questionnaire, the reliability test (Cronbach's Alpha coefficient) was subsequently executed on all questions with Likert-scaled responses. The Cronbach Alpha tests indicate the correlation between the respective item and the total sum score (without the respective item), and the internal consistency of the scale (coefficient alpha) if that particular item were to be excluded.

For some of the questions the responses had no variability, and as a result were excluded from the reliability testing - for example, question 4.8.13 had only one response - "Never" - and this was therefore excluded from the Cronbach Alpha test. The results, as recorded in Annexure K, indicate that the Cronbach's Alpha coefficients for all of the responses where a Likert scale served as a measuring instrument in the question's response, and excluding the items with no variability, are:

- 0.9509 for raw variables, and
- 0.9529 for standardized variables.

This is more than the acceptable level of 0.70 for measuring consistency of a measuring instrument (Nunnally, 1978:248-292). Thus, these questions and their responses were proved to be reliable and consistent.

The nature of the target group of recipients of the questionnaire is discussed in section 1.4.6.

1.4.6 Selection of respondents

This study is a continuation of the research done for the Masters in Auditing degree on the use of sampling within internal audit functions in the South African banking industry. (The degree was awarded by the Centre for Accounting, in the Faculty of Economic and Management Sciences at the University of the Free State, as was mentioned in section 1.4.1). Regulation 48 of the Banks Act requires all locally controlled banks to have a permanent internal audit function tasked with assessing the effectiveness and efficiency of the banks' risk management, governance and control processes (South Africa 2007a, sec. 90). Thus, the research population for this study consisted of CAEs of the in-house internal audit functions of all 10 locally controlled banks that were registered with the Reserve Bank at the time the research was conducted, and that were permitted to conduct the business of a bank in South Africa. The empirical results that emerged from the Masters study were based on a 90% response rate (as mentioned in section 1.4.1) from the universe of internal audit functions in locally controlled banks. The same 10 locally controlled banks were again the focus of this study as the internal audit methodologies and procedures that have been developed are maintained by the banks' South African head offices' internal audit functions and are in full compliance with South African legislation and regulations. These banks represent the locally controlled banking industry within South Africa (Reserve Bank, n.d. (b)). Internal audit methodologies used in the foreign banks have been developed and maintained at those banks' international head offices and they were therefore excluded from this study because of the diversity of legislation governing these functions. The choice of research population (locally controlled banks) means that the perceptions of the GAS used by internal audit functions are uniquely South African in perspective.

The locally controlled banking population consists of 10 banks, all of which have local in-house internal audit functions, and are permitted to conduct the business of a bank in South Africa (Reserve Bank, n.d. (b)). The research universe comprises only 10 locally controlled banks, and because this is a manageable number all 10 banks were included in the scope of this study. Bryman and Bell (2011:176) describe the selection of all items from a population as a census. The selection of a sample drawn from the population was therefore not necessary or appropriate for this research. The 10 locally controlled banks, in alphabetical order, are:

- African Bank
- Bidvest
- Capitec
- First Rand Bank
- Grindrod
- Investec
- Nedbank
- Sasfin
- Standard Bank
- UBANK

1.4.7 Data collection

The data collection process used in this study was sequentially collected as follows:

- An initial e-mail was sent to all the respondents requesting their formal participation in the research project (and to remind them of their previous input, where applicable). The email also contained an explanation of the process of gathering the data, as is required both from an ethical perspective, and to protect the confidentiality and integrity of the data. This initial e-mail was also accompanied by a covering letter (on an official University of the Free State letterhead) from the study leader and co-study leader in which the significance of the study and its research objectives were highlighted. This initial e-mail and the accompanying covering letter from the study leaders are included as Annexures D and E of this study.
- A second e-mail containing the structured questionnaire was then sent to those CAEs who had indicated their willingness to participate in the research. This email requested that they complete and return the questionnaire by a specific date.

- A follow-up e-mail was then sent to all those recipients who had not completed the questionnaire by the due date specified in the previous e-mail. An example of this follow-up e-mail sent to (non-) respondents is included as Annexure F.
- The feedback received from the respective CAEs (their completed questionnaires, and more particularly their voluntary and unstructured explanations to some of the questions) was then analysed in order to identify any feedback that was unclear. Unclear/ambiguous feedback was then clarified during a brief, semi-structured telephonic interview.

The structured questionnaire consisted of a combination of open and closed ended questions. A key characteristic of structured questionnaires is the fact that all participants are asked the same questions and are given the same response options (Hofstee, 2006:132). This enhances the comparability and reliability of the answers provided during the data analysis phase (Hofstee, 2006:133; Saunders *et al.,* 2009:362).

1.4.8 The capturing, editing and coding of the data

The capturing, editing and coding of the data is briefly discussed in section 4.3.

1.4.9 Data analysis

The data collected for this study consisted primarily of quantitative data, but with a small degree of supportive qualitative data (refer to section 1.4.3). The quantitative data for this study was analysed using the popular quantitative data management and statistical software application called Statistical Analysis Software (SAS). Quantitative data collected from responses to questionnaire surveys, like the one in this study, can be analysed or displayed through descriptive or inferential statistics (Burns & Burns, 2008:485). The quantitative data, for the purposes of this study, was analysed through the use of descriptive statistics. The purpose of descriptive statistics is to describe what the data looks like, and to compare variables numerically (Salkind, 2009:155; Saunders *et al*., 2012:502; Leedy & Ormrod, 2013:277). The data analysis processes used in this study are discussed in greater detail in section 4.1.

The banks' responses were analysed in the following sequence:

- A Cronbach alpha coefficient was calculated for all the Likert scaled data, to determine the reliability of the scale (refer to section 1.4.5).
- Descriptive statistics were calculated for each variable (question) in order to see how the answers were distributed.
- A measuring instrument was developed to measure the maturity levels of the use of GAS by internal audit functions in the South African banking industry, by using standardised values for the ordinal data and the dichotomous variables.
- Some cross table comparisons were performed in order to test the validity of the maturity allocations that had been made.

1.4.10 Research ethics

The ethical values associated with the internal audit profession, together with the IIA's Code of Ethics (IIA, 2009a) directed the researcher's efforts during this study (the researcher is a member of the international professional internal auditing body, namely the IIA). In addition, the study leader and co-study leader are both members of professional auditing bodies that also require them to act with the necessary respect for the ethical values upheld by those bodies' members. The required approval to conduct this study was also obtained from the Research Committee of the Faculty of Economic and Management Sciences of the University of the Free State.

1.5 SIGNIFICANCE OF THE STUDY

As far as can be determined no academic research has yet explored the use of GAS and/or assessed the level of maturity of its use by internal auditors in the locally controlled South African banking industry.

This study therefore contributes to the existing body of knowledge on GAS that is employed by internal auditors from a theoretical perspective. From a practical perspective, the research findings could assist CAEs and internal audit management within the South African banking industry to make better-informed decisions regarding the use of GAS, as it is intended that the results of the study can be used as a benchmark that will enable CAEs to identify whether they are staying abreast of current best practice in the area of technology-based tools and techniques for tests of controls. In addition, the Standards do not as yet contain guidelines regarding the use of GAS by internal auditors. This study can thus be seen as providing impetus for the IIA to formulate definitive guidelines regarding the use of GAS by internal auditors. In addition, the results of this study may also be useful for the Information Systems and Control Association (ISACA), an internationally recognised body that sets standards and that governs the professional execution of information systems audits (ISACA, 2013a). This study's findings may be a useful reference point from which to expand their guidance on the use of CAATs (performance guidance, *Evidence* (ISACA, 2014:110)), which includes GAS, to formally include the internal audit sphere.

1.6 CHAPTER OVERVIEW

This study is divided into five chapters, and a brief overview of the contents of each is provided next.

Chapter 1: Introduction and background

This chapter provides an overview of the internal audit profession and the impact advances in technology have had on the execution of its duties. The important role of the internal audit function within the banking industry is also emphasised. The study's problem statement and research objectives are also discussed and they form the basis for the rest of the study. The underlying theoretical framework, the research design, the selection of respondents, the collection of the empirical data and the analysis of the data collected are discussed in the research methodology section. This chapter then reviews the research ethics underpinning the research process and identifies the formal protocols followed to ensure the study adheres to all ethical requirements of the University of the Free State and those arising from the researcher's membership of the IIA. The chapter concludes with a discussion of the contributions that the results of this study could make to the existing body of knowledge on the use of GAS within the auditing profession.

Chapter 2: Internal audit as an assurance provider and its role in the banking industry in South Africa

An overview of internal audit as a twenty-first century profession is presented. This is followed by a discussion of the role of the internal audit function and its historic development within commerce and industry in general. The different types of technology-based tools available to the internal audit function (as defined by the IIA) are then discussed. As the IIA is the internal audit function's global representative professional body, its current role and history are also examined. The International Professional Practices Framework (IPPF) and the importance of the IIA's Standards are also discussed in this chapter. In addition, this chapter includes an overview of the internal audit function's relationship with the audit committee and with external audit. Thereafter, an overview of the internal audit function within the South African banking industry is provided. Central to this function's position in the banking industry is its ability to fulfil the requirements of the South African Reserve Bank's Supervisory Department and thus to fulfil the expectations of both international and South African shareholders, as well as depositors and other interested parties. The chapter concludes with a brief discussion of the use of technology-based tools by internal auditors.

Chapter 3: Technology-based tools and the internal audit function

Chapter 3 begins with a brief overview of the impact the development and implementation of technology (particularly IT and integrated management systems) in companies has had on the volumes of data generated. The use of technology in the banking industry is then briefly highlighted. This is followed by an overview of the use of technology by internal audit functions. The use of technology-based tools to collect audit evidence for the tests of controls is introduced next. GAS, as one of the key technology-based tools in widespread use is then discussed. Thereafter, the reasons for and the barriers inhibiting implementation of GAS as a technology-based tool available to internal auditors is discussed. For completeness, an overview of the traditional, manual auditing methods is presented and compared to the use of GAS. The chapter concludes with a discussion of the currently recognised data analytics maturity frameworks appropriate to assessing the performance of data analytics employing GAS.

Chapter 4: Empirical Results and Analysis

This chapter presents the findings and technical analysis of the empirical data gathered.

Chapter 5: Summary and Conclusion

On the basis of the findings presented in Chapter 4, a concluding overview of the use of GAS by internal auditors in the South African banking industry is presented in this chapter. The value of this study, as well as opportunities for future research, is also discussed.

1.7 CONCLUSION

The internal audit function is a key role player in assisting senior management and the board to achieve their respective objectives. The ever-changing organisational landscape, as well as the changing nature of risk, necessitates that the internal audit function continuously revisits its approaches to and the scope of work performed in order to stay abreast of current risks and to anticipate/pre-empt the emerging risks facing the banking industry. The internal audit profession is therefore not static but dynamic, and ever-evolving. Similarly, the audit tools and techniques that the internal audit function utilises in order to achieve its mandate (as it appears in the IIA's definition of internal audit), must remain in a state of dynamic evolution. A sound audit methodology should therefore incorporate the latest technology and specifically include the use of GAS as a minimum requirement in order for an internal audit function to successfully fulfil its mandate.

With reference to the number of local and international bank failures that have occurred in the last 40 years (as recorded in section 1.1) it is clear that the internal audit function's role will remain a vital contributor to a well-managed and sustainable banking industry. In addition, the use of data analytics tools and techniques, through the use of GAS, is fundamentally transforming internal audit methodologies. Their adoption should enable a more efficient analysis of data which is obtained from a broader audit coverage. This is especially important when conducting internal audits in the banking industry, which is characterised by significant volumes of data (as was mentioned in section 1.1).

Finally, internal audit functions should continuously strive to identify ways to "work smarter" and to be more efficient. The adoption and incorporation of GAS into internal audit's standard operating procedures should enable internal audit functions to adopt a proactive approach to their duties. This approach, particularly in the banking environment, should enable internal audit functions to respond more efficiently to the rising expectations of their various stakeholders as well as those of the vast majority of other organisations.

CHAPTER 2

INTERNAL AUDIT AS AN ASSURANCE PROVIDER AND ITS ROLE IN THE BANKING INDUSTRY IN SOUTH AFRICA

2.1 INTRODUCTION

Nothing focuses the mind more effectively than the threat of extinction. The international financial crisis that started in mid-2007 resulted in those responsible for corporate governance becoming increasingly aware of their changing risk environment. A significant number of banks failed around the world, leaving thousands of customers (depositors) in a state of anxiety: would they still be able to access their money tomorrow, or next week? (Section 1.1 presents a summary of significant local and international bank failures that occurred at that time). Bank failures that occurred as a result of the global financial recession of 2007, and the bank failures and/or bank scandals that have continued to occur at regular intervals, are as often as not a result of their own poor management, ineffective corporate governance, inadequate risk management practices and/or a general lack of internal controls (as mentioned in section 1.1).

Furthermore, section 1.1 also refers to the number of South African bank failures that have occurred over the last 40 years. These can also be attributed in the main to maladministration, fraud, ineffective risk management and poor corporate governance practices. The discovery and later public airing of these incidents of fraud and oversight failure, both locally and internationally, has re-energised efforts to strengthen corporate governance and risk management protocols in all formally constituted business entities, and especially (from the point of view of this study) in the banking industry. This increased attention on effective corporate governance has been further accentuated by the results following from a survey conducted by the Institute of Risk Management of South Africa (IRMSA). The survey (which included the financial services industry) identified corporate governance as one of the top 20 risks that South African organisations will face over the next two years (IRMSA, 2015:8; IRMSA, 2016:20). Similarly, the South African chapter of the IIA, in their report: *Corporate Governance Index 2014 and 2015*, demonstrates a decrease of

9.4% in the effectiveness of corporate governance for the country (the overall country index for corporate governance in 2013 was 3.2, compared to the index in 2014 and 2015, which was 2.9) (IIA (SA), 2014:3; IIA (SA), 2015:5). This may suggest that South African-based organisations (including those in the banking industry) are becoming less effective at implementing corporate governance strategies.

Effective corporate governance, with specific reference to the banking industry, is of crucial importance given the contribution that banks make to maintain the economic stability of a country (BIS, 2015a:3). The importance of corporate governance in the banking industry is best described in the words of David Carse, the former Deputy Chief Executive of the Hong Kong Monetary Authority (and a view that still hold true today):

> "*Corporate governance is of course not just important for banks. It is something that needs to be addressed in relation to all companies … I do however believe that sound corporate governance is particularly important for banks. The rapid changes brought about by globalization, deregulation and technological advances are increasing the risks in banking systems. Moreover, unlike other companies, most of the funds used by banks to conduct their business belong to their creditors, in particular to their* ***depositors****. Linked to this is the fact that the failure of a bank affects not only its own stakeholders, but may have a systemic impact on the stability of other banks. All the more reason therefore to try to ensure that banks are properly managed"* (cited in Reserve Bank, 2001:2).

Accordingly, organisations including the banking industry are becoming increasingly conscious of the value of having an effective and efficient internal audit function (Nelson, 2002; Smith, 2002:13; Deakin & Konzelman, 2004:140; IOD, 2009:95; Thomson Reuters, 2012:4; EY, 2012:21; PwC, 2013:3; IOD, 2016:70). The IIA's Position Paper, *The three lines of defence in effective risk management and control,* supports this view and suggests that an effective internal audit function should be a governance requirement for every organisation irrespective of the industry in which it operates (IIA, 2013:5). Internal audit is uniquely positioned as the *third line of defence* with regard to an evaluation of the effectiveness of an organisation's governance, risk management and internal controls (BIS, 2012:13; COSO, 2013:147;

IIA, 2013:5). This means that, in addition to its purpose as stipulated in the definition of internal audit (as was mentioned in section 1), the internal audit function also includes in its effectiveness evaluation the achievement of the risk management and control objectives which were implemented by the first line of defence (management and other personnel responsible for the implementation of controls and the day-to-day managing of an organisation) and the second line of defence (business support functions such as risk management, compliance and legal) (BIS, 2012:13; COSO, 2013:147; IIA, 2013:4). As a result, pressure is increasingly being felt by organisations' boards of directors and their audit committees as they are required to demonstrate that their organisations are being managed effectively, and with due cognisance for their long-term sustainability. These objectives could be achieved by adhering to good corporate governance and risk management practices.

The 2009 King Report on Corporate Governance for South Africa (King III Report) has become the blueprint for defining and implementing the ideals embodied in the concepts of ethical leadership and responsible corporate citizenship. As a key contributor to achieving these ideals, in both the King III and King IV Reports the importance of the role of an independent and respected internal audit function in a company is highlighted (IOD, 2009:93; IOD, 2016:31). The role of the internal audit function in the international and local banking industries will be discussed later, in sections 2.6.1 and 2.6.2 respectively.

The key outcome from the international financial crisis of mid-2007, and the subsequent discoveries of fraud, theft and maladministration in all business sectors, has been a re-emphasis of the importance of an independent assurance function within a company; and the banking industry appears now to be leading the process of improving its strategies and their implementation. The Basel Committee recently issued two authoritative guidelines, namely: *The internal audit function in banks* and *Corporate governance principles in banks,* published in 2012 and 2015 respectively (BIS, 2012; BIS, 2015a). These provide the structure and amplify the processes needed to enhance the prominence of the role the internal audit function plays in the evaluation of the effectiveness of banks' risk management, controls and governance processes (BIS, 2012:4; FSB, 2013:15; BIS, 2015a:32).

The internal audit function has maintained its evolutionary momentum since its establishment as a profession in 1941, by means of regular assessments of itself and its relation with the changing needs of the business world in which it operates. This is especially visible in the banking industry, where regulatory and statutory oversight is particularly onerous. It is therefore not surprising to find that internal auditors focus on risk management, fraud prevention and corporate governance (Deloitte, 2009:7; IOD, 2009:95; IIA, 2010b; EY, 2012:21; Thomson Reuters, 2012:4; PwC, 2013a:4; IIA, 2015g:6; IOD, 2016:69). Section 2.2.4 provides a brief overview of some of the other internal audit engagements that the internal audit function may be required to perform.

This chapter provides a brief overview of internal audit as a twenty-first century profession. This is followed by a discussion of the role of the internal audit function and its historic development within commerce and industry in general. As the IIA is the internal audit function's global representative professional body, its current role and history is also examined. The IIA's International Professional Practices Framework (IPPF) and the importance of the IIA's Standards are also discussed in this chapter. In addition, this chapter includes an overview of the internal audit function's relationship with the audit committee and the external audit function. Thereafter, an overview of the internal audit function within the South African banking industry is provided. Central to this function's position in the banking industry is its ability to fulfil the requirements of the South African Reserve Bank's Supervisory Department, and thus to fulfil the expectations of both international and South African shareholders, as well as depositors and other interested parties. The chapter concludes with a brief discussion of the use of technology-based tools by internal auditors.

2.2 THE INTERNAL AUDITING PROFESSION

Risk is fundamental to the activities of all organisations and industries, and the impact of these risks is mitigated by the management teams' abilities to implement controls that protect their organisations' activities (COSO, 2013:59). The management team receives delegated authority from (and is thus accountable to) the board of directors to oversee the day-to-day running of the organisation in a manner that supports its ‘going concern’ status (IOD, 2009:75; IOD, 2016:47). The board of directors exercises overall responsibility for (and directors are held jointly accountable for) the effective running of an organisation; their duties include, amongst others, the governance of risk, financial soundness of an organisation and the formulation of the organisation’s strategy (IOD, 2009:74; COSO, 2013:42; BIS, 2015a:8; IOD, 2016:47). The board of directors however, almost inevitably has a ‘top-down’ view of the organisation, necessitating assistance from operational and advisory functions ‘within’ the organisation - hence its reliance on the reports of the audit committee and the internal audit function regarding the effectiveness of the company’s business efforts. The internal audit function should thus perform an independent assessment of the status and operational effectiveness of the controls that have been implemented by management, and then express an opinion as to the effectiveness of the company’s risk management, controls and governance processes. Internal audit is therefore a vital role-player within an organisation.

In section 1.1 reference was made to the current definition of internal audit, adopted by the IIA in 1999. (Table 2.1 highlights the key changes in the development of the internal audit function’s ‘statement of responsibilities’). The IIA’s current definition of the internal audit function states that it is *“A department, division, team of consultants, or other practitioner(s) that provides independent, objective assurance and consulting services designed to add value and improve an organisation’s operations. The internal audit activity* ***helps an organisation accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of governance, risk management and control processes”*** [own emphasis] (IIA, 2012a:21).

According to the IIA’s current definition of internal audit, the function is no longer limited to providing assurance services only; their duties may now also include the provision of consulting services. In South Africa, the Banks Act also permits the internal audit function to provide consulting services to their bank’s senior management regarding the bank’s internal controls (South Africa, 2007a, sec.48 (n)). Recent surveys conducted by PricewaterhouseCoopers *(2015 State of the Internal Audit Profession Study)* and the IIA *(A Global View of Financial Services Auditing)* conclude that globally, stakeholders have rising expectations regarding the value that the internal audit function should be able to provide through its consulting role (IIA, 2015g:4; PwC, 2015:6). The internal audit function's consulting role includes the provision of training in the implementation of internal controls; advising management on the state of its controls, and on present and potential risks; alerting the board to changes in the corporate governance arena, and the drafting of policies, amongst many more (IIA, 2012a:20; Nagy & Cenker, 2004:52).

Internal auditing is one of the four cornerstones of a company's corporate governance, with the board of directors, senior management, and external auditing providing the balance (BIS, 2012:1; FSB, 2013:14; BIS, 2015a:32). Internal audits should be performed by professionals who understand the company's culture, systems and processes, and the independent evaluation arising from the audit should assist an organisation to achieve its set objectives (IIA, 2016n). The skillset possessed by an internal audit function should be broad and diverse, and backed by a willingness (and budget) to engage specialist expertise as and when the audit engagement requires this. Typically, this specialist expertise is drawn from disciplines such as engineering, operations, accounting and information technology (IIA, n.d.:4). As management's "eyes and ears", internal auditors are routinely consulted on any and all aspects of the organisation's operations. These services range from providing training in risk management, advising on the management of internal and external stakeholders' expectations, updating risk managers and controls experts on the latest threat trends, to engaging with efficiency specialists and specialist problem-solving partners (IIA, n.d.:6). The modern internal audit function thus works with management in its efforts to prevent and/or contain risk and fraudulent activities (refer to section 2.2.6).

Over the last 75 years, since the formal establishment of the IIA in 1941, the formal internal audit function has undergone a dramatic evolution. Section 2.2.1 provides a brief history of this professional evolution.

2.2.1 A brief history of the origin and development of internal auditing

The concept of auditing has been traced back at least to 3000 B.C., where archaeological evidence comprising documents in the form of clay tablets from the Mesopotamian civilisations have been found. These documents contain ticks and check-marks which appear to indicate that an auditing function was then already in effect (Kenneth, 1959:563; Stone, 1969:284; Sawyer, 1993:43; Smith, 2004:32; Coetzee, 2010:58). Internal auditors were primarily seen as providing a policing function and mainly performed accounting and clerical tasks to assist the external auditor (Cunningham, 1948:606; Kent, 1957:7; Guoming, 1997:243; Dittenhofer, 2001:468; Smith, 2004:33).

Despite its ancient roots, internal audit was not regarded as a profession until after the establishment of the IIA in 1941 (see Table 2.1). Prior to this event, internal audit possessed none of the recognised characteristics of a professional body: thus, there was no mission statement and/or definition of the function, nor formal definitions of its scope of services, or extent of responsibilities. No formal standards or guidelines against which to evaluate the quality of the service had been universally agreed on, nor was there a formally recognised code of ethics against which to judge the manner in which internal auditors conducted their duties (Abdolmohammadi, Burnaby, & Hass, 2006:811; Chambers, 2011:7). The internal audit function's duties were limited to accounting and clerical tasks, being viewed as a sometimes necessary and useful set of extra hands and eyes taking care of the business for management. The impetus to achieve universally recognised professional status and to be seen as an essential, value-adding function, began in the 1940s, but this process is still far from universally complete.

The social and economic turmoil of the 1940s provided the internal audit function with focus and motivation to professionalise. Table 2.1 provides key events in the history of the internal audit profession from 1941-2016.

Table 2.1: Key milestones in the history of the internal audit profession from 1941 – 2016

YEAR	HISTORICAL PERSPECTIVE OR MILESTONE	STATEMENT OF RESPONSIBILITIES OF THE INTERNAL AUDITOR (DEFINITION OF INTERNAL AUDITING)
1941	The establishment of the IIA in New York: 24 founding members (Guoming, 1997:243; Burnaby & Hass, 2009:736; IIA, 2016k).	Not yet defined.
1947	The IIA's first *Statement of Responsibilities of the Internal Auditor* is issued (Cunningham, 1948:608; Sawyer, Dittenhofer & Scheiner, 2003:12; Chapman, 2004:40).	The first *Statement* defines internal auditing as: *"An independent appraisal activity within an organisation for the review of the accounting, financial, and other operations as a basis for protective and constructive service to management. It deals primarily with accounting and financial matters but it may also properly deal with matters of an operating nature"* (cited in Gupta, 1991:137; Chambers, 2009:28).
1957	The IIA issues its second, (revised) *Statement of Responsibilities* (Gupta, 1991:137).	The second *Statement* defines internal auditing as: *"An independent appraisal activity within an organisation for the review of accounting, financial, and other operations as a basis for service to management. It is a managerial control, which functions by*

YEAR	HISTORICAL PERSPECTIVE OR MILESTONE	STATEMENT OF RESPONSIBILITIES OF THE INTERNAL AUDITOR (DEFINITION OF INTERNAL AUDITING)
		measuring and evaluating the effectiveness of other controls" (cited in Gupta, 1991:138).
1968	The IIA adopts its first *Code of Ethics* (IIA, 1968; Ramamoorti, 2003:7).	The second *Statement (definition of internal auditing)* (issued in 1957) remains unchanged.
1970	The IIA institutes a certification program for aspirant internal auditors (Gupta, 1991:138; O'Regan, 2001:218).	The second *Statement (definition of internal auditing)* (issued in 1957) remains unchanged.
1971	The IIA issues its third (revised) *Statement of Responsibilities* (Gupta, 1991:138; IIA, 1971; Sawyer *et al*., 2003:13).	The third *Statement* defines internal auditing as: *"An independent appraisal activity within an organisation for the review of operations as a service to management. It is a managerial control which functions by measuring the effectiveness of other controls"* (IIA, 1971).
1978	The IIA formally approves the *Standards for the Professional Practice of Internal Auditing* (Ramamoorti, 2003:6; O'Regan, 2001:219; Chapman, 2004:40; Chambers, 2015:35).	The third (and fourth) *Statement (definition of internal auditing)* (issued in 1971) remains unchanged.
1981	The IIA revised its fourth *Statement of Responsibilities* and issued its *fifth* statement	The fifth *Statement (definition of internal auditing)* reflects the broadening scope of internal

YEAR	HISTORICAL PERSPECTIVE OR MILESTONE	STATEMENT OF RESPONSIBILITIES OF THE INTERNAL AUDITOR (DEFINITION OF INTERNAL AUDITING)
	(Gupta, 1991:139; IIA, 1981; Sawyer *et al*., 2003:13).	auditing, with the inclusion of the audit of economy and efficiency, as well as program evaluation audits (IIA, 1981).
1988	The IIA adopts its second version of the *Code of Ethics* (IIA, 1988).	The fifth *Statement (definition of internal auditing)* (issued in 1981) remains unchanged.
1990	The IIA issues its sixth (revised) *Statement of Responsibilities* (Gupta, 1991:139; IIA, 1990).	The sixth *Statement* reflects the further broadening of the scope of internal auditing by redefining it as *"… an independent appraisal function established within an organisation to examine and evaluate its activities as a service to the organisation"* (cited in Gupta 1991:139; IIA, 1990).
1993	The IIA issues its seventh (revised) *Statement of Responsibilities* (Gupta, 1991:139).	The scope of internal audit, as reflected in the seventh *Statement,* is extended to include the following: *"The examination and evaluation of the adequacy and effectiveness of the organisation's system of internal control and the quality of performance in carrying out assigned responsibilities"* (Ramamoorti, 2003:8).

YEAR	HISTORICAL PERSPECTIVE OR MILESTONE	STATEMENT OF RESPONSIBILITIES OF THE INTERNAL AUDITOR (DEFINITION OF INTERNAL AUDITING)
1999	The IIA issues its eighth (revised) *Statement of Responsibilities* (IIA, 1999; Chapman, 2004:42; Nagy & Cenker, 2002:130; Smith, 2004:32).	The eighth *Statement* defines internal auditing as *"… an independent, objective assurance and consulting activity designed to add value and improve an organization's operations. It helps an organization accomplish its objectives by bringing a systematic, disciplined approach to evaluate and improve the effectiveness of risk management, control, and governance processes"* (IIA, 1999; Chapman, 2004:42; Nagy & Cenker, 2002:130; Smith, 2004:32; Chambers, 2009:28).
2000	The IIA adopts its third version of the *Code of Ethics* (IIA, 2000).	The eighth *Statement of Responsibilities of the Internal Auditor* remains in force and is unchanged from the 1999 definition of internal auditing, adopted in 1999 (IIA, 2012a:21).
2013	The *Standards are* revised (2012) and come into effect on 1 January 2013 (IIA, 2012a).	The eighth *Statement of Responsibilities of the Internal Auditor* remains in force and is unchanged from the 1999 definition of internal auditing, adopted in 1999 (IIA, 2012a:21).

YEAR	HISTORICAL PERSPECTIVE OR MILESTONE	STATEMENT OF RESPONSIBILITIES OF THE INTERNAL AUDITOR (DEFINITION OF INTERNAL AUDITING)
2015	The IIA's International Professional Practices Framework (IPPF) was updated and implemented on 6 July 2015. The most significant updates to the IPPF were the introduction of a *Mission Statement* for the internal audit function as well as the implementation of *10 Core Principals for the Professional Practice of Internal Auditing* (IIA, 2015b).	The eighth *Statement of Responsibilities of the Internal Auditor* remains in force and is unchanged from the 1999 definition of internal auditing, adopted in 1999 (IIA, 2012a:21).
2016	The *Standards are* revised (October 2016) and come into effect on 1 January 2017 (IIA, 2016p).	The eighth *Statement of Responsibilities of the Internal Auditor* remains in force and is unchanged from the 1999 definition of internal auditing, adopted in 1999 (IIA, 2016q:23).

(Source: own deduction)

As evidence of the IIA's intention to add value to their parent entities by remaining abreast of changes in the business environment, the IIA has revised its *Statement of Responsibilities of the Internal Auditor* eight times during the now more than seventy years of its existence. These changes have been necessitated by the accelerating increases in complexity of business organisations and the world in which they operate, paralleled by the explosion of potential risk exposure enabled by the computer and internet era.

The continuous and accelerating rate of change in organisations over the last two centuries – from the creation of increasingly complex products and services to operational and administrative issues associated with their creation – has resulted in a similar growth in the complexity of "simply" managing organisations. This has led to management recognising its need for independent assistance to assess the effectiveness and extent of controls, and the efficiency of operations throughout the organisation (IIA, 2016k). Management's need gave the internal auditing function the impetus it needed to begin the process, in 1941, of professionalisation (Cunningham, 1948:606). As Arthur E. Hald, one of the founding members of the IIA (cited in Flesher, 1996:3) remarked,

> *"Necessity created internal auditing and is making it an integral part of modern business. No large business can escape it. If they haven't got it now, they will have to have it sooner or later, and, if events keep developing as they do at present, they will have to have it sooner."*

Table 2.1 traces internal audit's shifting focus from its 1940s role as a policing function (performing mainly clerical accounting work), to its position today (refer to section 2.2.6) as an independent advisory function, reporting to the highest levels of the entity on issues of fundamental importance to the wellbeing of the organisation (IIA, n.d.; Dittenhofer, 2001:468; Coetzee, 2010:57; Leech, 2015:48; Pizzini, Lin & Ziegenfuss, 2015:26; PwC, 2015:6).

The evolution of internal auditing since 1941 has included the development and implementation of the International Professional Practices Framework – the IPPF. The key components of the IPPF include the Mission of Internal Audit, the Core Principles for the Professional Practice of Internal Auditing, the Professional Standards, the IIA's Code of Ethics and the formal definition of internal audit. The IPPF gives effect to the internal audit function's claim to professionalism, and this is supported by the IIA's global network of regional chapters and affiliate organisations (IIA, 2016b). The IPPF will be discussed in section 2.3.1. The internal audit function of today forms an integral part of an increasing majority of organisations, fulfilling its unique purpose as assessor of and guide to management in management's efforts to sustain the entity's viability.

2.2.2 Internal audit's purpose, authority and responsibility

It is not unexpected that the South African Reserve Bank's (Reserve Bank) Bank Supervision Department (the Supervisor), is one of the key stakeholders with vested interests in the ongoing success of banks in South Africa, and particularly in the role the internal audit function plays in risk management, fraud prevention and corporate governance. The individual banks' boards of directors, audit committees and senior management have similarly rising expectations of their internal audit functions (South Africa, 2007a, sec.48 (v)(i); Trudell, 2014:371; BIS, 2015d:18; Abdullatif & Kawuq, 2015:46; Chambers, 2015:46). The King III Report, as well as the King IV Report, also recognise internal audit's main responsibility as being to provide an independent evaluation of the effectiveness of risk management, controls and governance practices, which it is required to communicate with the company's board of directors and/or its sub-committees, in order that the various company objectives may be more efficiently and effectively achieved (IOD, 2009:93; IOD, 2016:69). The Basel Committee similarly requires that the internal audit function in a bank reports directly to the board, or its audit committee, in terms of its mandate as recorded in the internal audit charter (BIS, 2012:12; BIS, 2015a:32). The FSB's 2013 bank survey agrees with this reporting structure and delegated authority, and emphasises that the internal audit function is a permanent function within banks (FSB, 2013:G44-G58). The internal audit function's authority and standing within the entity is derived from its having direct communication channels with the company's board of directors and/or audit committee, and this enables it to successfully conduct its duties.

Internal audit's purpose and mandate are currently defined in the 1999 revision of the Statement of Responsibilities of the Internal Auditor (refer to section 2.2.1), in which the function's main purpose is identified as the provision of an independent assurance and consulting service to an organisation's senior management, its board of directors and/or its audit committee. It is specifically tasked to assess the adequacy and effectiveness of a company's risk management, control and governance processes. As corroborated by the International Standard on Auditing (ISA) 610, the internal audit function may:

- monitor a company's internal control environment;
- inspect a company's financial and operating information;
- evaluate a company's operating activities;
- evaluate a company's compliance with laws and regulations;
- assess the effectiveness of a company's risk management practices; and/or
- assess the effectiveness of a company's governance processes in support of the company's set objectives (IAASB, 2015; ISA 610 par. A1).

The input of internal auditors is therefore critical to the success and survival of an organisation. Thus, any situation, process or attitude that might negatively impact the company's risk management, control and governance processes has to be reported to senior management and the audit committee.

However, without appropriate support from senior management and the board (including its audit committee), the effectiveness of an internal audit function is likely to be compromised. If internal audit's observations and recommendations are taken seriously by the management team, this is apparent in that someone has taken responsibility for turning the reported observations and recommendations into appropriate and effective corrective steps, thus mitigating the reported risk (IIA, 2012a:18, Standard 2500.A1). The internal audit function's authority should be formally recorded in the internal audit charter. Additionally, the formal internal audit charter should stipulate the extent of the function's authority and mandate, granting it unimpeded access to all records and personnel necessary to complete their internal audits (BIS, 2012:2; IIA, 2012a:3, Standard 1000; FSB, 2013:24; BIS, 2015a:32). The charter should also record that the CAE's functional reporting line is to the board, as this confirms that the internal audit function has the authority to speak and to be heard within an organisation. In addition, being granted direct access to the board and/or its audit committee ensures that the internal audit function's independence and authority are beyond question. The final "stamp of authority" on the internal audit charter should come from the board of directors and/or its audit committee, who should also formally approve the internal audit function's methodology (IIA, 2012a:3, Standard 1000).

2.2.3 Internal audit methodology

The internal audit profession's evolution (also refer to sections 2.2.5 and 2.2.6 respectively) over the last few decades has compelled it to effect changes in its methods: internal audit is no longer process based; the current focus is on risk based internal auditing and on the integration of technology into the internal audit methodology (Coetzee & Lubbe, 2014:119; IIA, 2015g:10; Motubatse, van Staden, Steyn & Erasmus, 2015:271; Sun, Alles & Vasarhelyi, 2015:177). The Standards also stress the importance of risk based internal auditing (IIA, 2012a:9, Standard 2010), as do the Basel Committee's specifications (BIS, 2012:4; BIS, 2015a:5) and the King III and King IV Reports (IOD, 2009:94; IOD, 2016:70). The key characteristic of risk based internal auditing is its analysis of management's assessment of risk in order to prioritise internal audit's efforts to address the most vulnerable areas and/or the most probable risks facing the organisation (Protiviti, 2015a:26; PwC, 2015:7). In supporting this view, the Standards require that the CAE's risk-based plan recognises and accommodates the organisation's risk management framework and management's risk appetite levels (IIA, 2012a:9, Standard 2010). Ideally, the internal audit function develops a risk-based plan from management's assessment of the organisation's risk framework. However, organisations (and divisions within organisations) have differing levels of risk maturity (and might not even have a view of the risks they face), which then requires that the internal audit function engages with senior management and the board to develop a workable risk framework within which to perform their audit of the organisation or division (IIA, 2012a:9, Standard 2010).

Internal audit is required to evaluate the adequacy and effectiveness of the risk management process that senior management has devised and implemented. This evaluation provides a benchmark and an opinion that should enable management to address (manage or reduce) the risks facing the organisation so that they fall to levels acceptable to the board of directors (South Africa, 2007a, sec.48 (l)(iv); FSB, 2013:14; BIS, 2015a:5). By definition, this evaluation should be systematic in nature (internal audit (refer to section 1.1) is defined as a "… systematic, disciplined approach") in order to evaluate the adequacy and effectiveness of the organisation's risk management, its controls and the governance processes. The IIA's Performance Standards reinforce the systematic nature of the internal audit engagement:

- Phase 1: Engagement Planning (IIA, 2012a, Standard 2200, 2220, 2230).
- Phase 2: Risk Analysis (IIA, 2012a, Standard 2201).
- Phase 3: Fieldwork (IIA, 2012a, Standard 2240, 2300, 2310, 2320).
- Phase 4: Reporting (IIA, 2012a, Standard 2330, 2400, 2420).
- Phase 5: Follow-up (IIA, 2012a, Standard 2500).

Following from the above, it is clear that an internal audit engagement is conducted in a systematic manner with interdependent phases, (each one feeding into the subsequent one). The internal audit function's risk based annual plan guides the focus of the audit engagement. Each of the risks recorded in the risk based annual plan, regardless of origin (whether management's risk framework or internal audit's own assessment of the organisation's key risks), becomes an individual internal audit engagement. The initial, planning phase of the engagement includes the engagement's objectives, scope, timing, and resource allocations – thus defining the basis for the subsequent audit (IIA, 2012a:13, Standard 2200). This phase should further consider the organisation's strategies, objectives and risks as they pertain to the upcoming engagement. The risks identified in the scope of the engagement are then assessed and ranked according to the likelihood of the threats materialising. This risk based approach then guides the allocation of audit effort and resources to those areas where the organisation is at greatest risk, and where the organisation can benefit most from the efficiency- and effectiveness-enhancing insights of the audit (IIA, 2015e:4; Protiviti, 2015a:26; PwC, 2015:7).

The next step in the audit process is the fieldwork, the test procedures that determine the effectiveness of management's risk-mitigating controls in the areas of greatest identified risk. A formal record of these test procedures is kept in the engagement work program, detailing the tests used to identify, analyse and evaluate the controls, together with any other pertinent information that is discovered during the engagement (IIA, 2012a:14, Standard 2240). One of the numerous techniques available to the internal auditors in order to collect sufficient, reliable, relevant, and useful information in support of the engagement's objectives is the use of technology-based tools such as CAATs and GAS (Mahzan & Lymer, 2014:328; Shiau, 2014:22). This is also formally recorded in the engagement's work program (IIA, 2015h, Practice Advisory 2240-1). Chapter 3 provides a detailed discussion of the use of CAATs and GAS by internal auditors when they review tests of controls.

Once the fieldwork phase has been concluded, the information that was collected is analysed, and the final outcome - the audit opinion or conclusion – is prepared. This is a formal statement of the adequacy and effectiveness of management's controls for the risk areas selected for internal audit's test procedures (IIA, 2012a:15, Standard 2320). Exceptions (where controls are inadequate and/or ineffective) must be formally recorded in the internal auditor's report to management. The report must include a reiteration of the engagement's objectives and scope, as context for the audit's conclusions, recommendations, and action plans (IIA, 2012a:15, Standard 2410). Once management has had sufficient time to action the report's recommendations, the internal auditors perform a follow-up engagement focusing on management's response to the exceptions identified in the report, and the corrective actions. The systematic, disciplined and risk-based approach of the internal audit function, as discussed in this section, can be applied across a number of individual audit engagements inside an organisation and/or a bank.

2.2.4 Internal audit categories

Internal auditors are uniquely positioned within an organisation and therefore should perform a wide variety of tasks throughout an organisation in accordance with its mandate and its enhanced scope of services, as was highlighted in section 2.2.2. These services may range from performing financial control audits to the assessment of the organisation's compliance with respect to mandatory laws and regulations, and may include playing an active role in the evaluation of the strategic, operational and technological risks an organisation is exposed to (Al Hosban, 2015:167; IIA, 2015a:5; KPMG, 2015a:4; PwC, 2015:6). Furthermore, the internal auditors can also play a key role in assisting an organisation's management team in addressing the risk of fraud (IIA, 2009b:1; Al Hosban, 2015:167). Accordingly, the internal auditor performs a number of different audit engagements: some of the main audit engagements or audit categories that internal auditors perform are now briefly discussed:

2.2.4.1 Fraud audits

The risk of fraud has business consequences and addressing this is an important responsibility for an organisation's board and senior management (COSO, 2013:42). Equally important is the CAE's responsibility to ensure that the internal audit function delivers on its mandate in line with the function's purpose, authority and responsibility (refer to section 2.2.2). Petrascu and Tieanu (2014:492) also highlight the importance of the internal audit function's responsibility in providing an independent assessment of fraud risks and of fraud-mitigating actions that have been implemented by an organisation's board and senior management. The CAE should therefore ensure that it incorporates the risk of fraud in its audit coverage plan for each respective audit engagement (Lament, 2014:23; Laxman, Randles & Nair, 2014:50). Furthermore, the IIA in its global report, *Responding to fraud risk: Exploring where Internal Auditing stands* (IIA, 2015d:12) also confirms the internal audit functions' role with regard to the risk of fraud.

The IIA's IPPF defines fraud as: *"… any illegal act characterized by deceit, concealment, or violation of trust. These acts are not dependent upon the threat of violence or physical force. Frauds are perpetrated by parties and organizations to obtain money, property, or services; to avoid payment or loss of services; or to secure personal or business advantage"* (IIA, 2009b:1). The following Standards also make reference to the internal audit function's responsibility with regard to the evaluation of the risk of fraud:

Standard 1210.A2, *Proficiency* – *"Internal auditors must have sufficient knowledge to evaluate the risk of **fraud*** [own emphasis] *and the manner in which it is managed by the organization, but are not expected to have the expertise of a person whose primary responsibility is detecting and investigating fraud"* (IIA, 2012a:6).

Standard 1220.A1, *Due Professional Care* – "*Internal auditors must exercise due professional care by considering the:*

- *Extent of work needed to achieve the engagement's objectives;*
- *Relative complexity, materiality, or significance of matters to which assurance procedures are applied;*
- *Adequacy and effectiveness of governance, risk management, and control processes;*
- *Probability of significant errors, **fraud*** [own emphasis]*, or noncompliance; and*
- *Cost of assurance in relation to potential benefits"* (IIA, 2012a:6).

Standard 2060 – *Reporting to Senior Management and the Board* – *"The chief audit executive must report periodically to senior management and the board on the internal audit activity's purpose, authority, responsibility, and performance relative to its plan and on its conformance with the Code of Ethics and the Standards. Reporting must also include significant risk and control issues, including **fraud risks*** [own emphasis]*, governance issues, and other matters that require the attention of senior management and/or the board"* (IIA, 2012a:10).

Standard 2120.A2, *Risk management* – *"The internal audit activity must evaluate the potential for the occurrence of **fraud*** [own emphasis] *and how the organization manages fraud risk"* (IIA, 2012a:12).

Standard 2210.A2, *Engagement objectives* – *"Internal auditors must consider the probability of significant errors, **fraud*** [own emphasis]*, noncompliance, and other exposures when developing the engagement objectives"* (IIA, 2012a:13).

It is evident from the above that the internal audit function has an important role and contribution to make with regard to the risk of fraud when delivering on its mandate.

2.2.4.2 Operational audits

Management of an organisation is continuously seeking additional information with regard to the efficiency and effectiveness of and economic savings achieved by their businesses' activities. One of the main measurements of the success of an organisation is its financial performance. Consequently, financial audits by internal auditors are conducted in order to verify the accuracy of an organisation's financial statements. These types of audits however are limited in the extent to which they can provide management with information and meaningful analysis regarding an organisation's operations (i.e., the effectiveness of actions). As a result of management's need for this additional information, operational audits (in addition to financial audits) became commonplace (Khalili, Tehrani, Karami & Jandaghi, 2012:661). The purpose of an operational audit is to perform a systematic assessment of an organisation's operations in order to express an opinion with respect to the *effectiveness* of the achievement of its set objectives, the *efficiency* of operations (i.e., can they do more with less money?) and the *economic* justification of the organisation's operations (Balkaran, 2014:14; Malihi, 2015:134).

In addition, Standard 2100, *Nature of work*, requires the internal audit function to perform a systematic risk-based assessment on the governance, risk management and effectiveness of controls that reside within an organisation (IIA, 2012a:11). That the internal audit function is required to perform these duties further emphasises the importance of the contribution an internal audit function has as an independent assurance provider which includes the conduct of operational audits.

Although it is important for organisations to ensure they conduct business in an effective, efficient and economical manner, it is equally important to ensure that they do not harm the environments (physical, social, and economic, amongst others) in which they operate. The following section briefly highlights the important roles that internal auditors play in conducting environmental audits.

2.2.4.3 Environmental audits

Organisations can no longer conduct business with the only aim being to generate profits. Increasingly, organisations (local and international) are being held accountable for the "footprint" that they leave on the environment in which they conduct their business. In South Africa and in particular as iterated in the King III and King IV Reports (IOD, 2009:109: IOD, 2016:4), companies' boards of directors and management are required to be cognisant of the impact their business activities have on the environment. The King reports also require the company's integrated report to address its impact on economic, social and environmental issues as they pertain to the company's sustainability. In addition to being guided into an expanded awareness of their local environment by the King Reports, companies now also have to comply with the International Standards Organisation's (ISO) various standards. The ISO is also a key provider of global standards and guidelines intended to assist organisations to improve their environmental performance (i.e., to reduce their negative impact on the environment) through more efficient use of resources and the reduction of waste. In so doing (through the implementation of an environmental management system), companies are likely to gain a competitive advantage, as well as the trust of their various stakeholders (ISO, 2015:2).

In addition, an organisation's board of directors and management must ensure that its risk register is holistic and that it includes environmental issues (COSO, 2013:71). For this reason, organisations' management teams increasingly rely on the independent assurance provided by the internal audit function regarding the effectiveness of their environmental management systems (Dominic & Martinov-Bennie, 2014:81; Trotman & Trotman, 2015:209). An effective environmental management system should provide the organisation with the tools that enable it to identify, manage, monitor and control their environmental risks in an effective manner (ISO, 2015:2).

Non-compliance with environmental laws and regulations can also have costly legal implications for organisations and can result in criminal charges being laid against individuals. The next audit category briefly highlights the internal audit function's responsibility with regard to compliance audits.

2.2.4.4 Compliance audits

All organisations, irrespective of the industry, have to abide by the specific requirements of legislation and regulation: and for financial service providers, including banks, there is an additional and onerous body of legislation that is unique to their section of the business spectrum. Organisations that fail to comply with these legal and regulatory requirements can become involved in costly lawsuits and end up with badly tarnished reputations, amongst other negative outcomes. The King III

Report stipulates that a company's board of directors is responsible for ensuring that the company adheres to applicable laws and regulations. It also emphasises the importance of integrating compliance risk into the company's overall risk management process (IOD, 2009:90). The importance of this monitoring role performed by a company's board of directors with regard to the regulatory environment is also emphasised in the King IV Report (IOD, 2016:63).

The Standards also describe the internal audit function's responsibility with regard to its independent assessment of an organisation's compliance risks:

Standard 1220.A1, *Due Professional Care* – "*Internal auditors must exercise due professional care by considering the:*

- *Extent of work needed to achieve the engagement's objectives;*
- *Relative complexity, materiality, or significance of matters to which assurance procedures are applied;*
- *Adequacy and effectiveness of governance, risk management, and control processes;*
- *Probability of significant errors, fraud, or* ***noncompliance*** [own emphasis]*; and*
- *Cost of assurance in relation to potential benefits"* (IIA, 2012a:6).

Standard 2120.A1, *Risk management* – "*The internal audit activity must evaluate risk exposures relating to the organization's governance, operations, and information systems regarding the:*

- *Achievement of the organization's strategic objectives;*
- *Reliability and integrity of financial and operational information;*
- *Effectiveness and efficiency of operations and programs;*
- *Safeguarding of assets; and*
- ***Compliance with laws, regulations, policies, procedures, and contracts****"* [own emphasis] (IIA, 2012a:12).

Standard 2130.A1, *Control* – 2130.A1 – "*The internal audit activity must evaluate the adequacy and effectiveness of controls in responding to risks within the organization's governance, operations, and information systems regarding the:*

- *Achievement of the organization's strategic objectives;*
- *Reliability and integrity of financial and operational information;*
- *Effectiveness and efficiency of operations and programs;*
- *Safeguarding of assets; and*
- ***Compliance with laws, regulations, policies, procedures, and contracts**"* [own emphasis] (IIA, 2012a:12).

Standard 2210.A2, *Engagement objectives* – *"Internal auditors must consider the probability of significant errors, fraud,* ***noncompliance*** [own emphasis] *and other exposures when developing the engagement objectives"* (IIA, 2012a:13).

The scope of compliance audits will usually include an assessment of an organisation's compliance with policies, plans, procedures, laws, regulations, contracts, or other applicable requirements (IIA, 2012a:19).

2.2.4.5 Financial control audits

Both the King III and King IV Reports identify the audit committee as one of the main governing bodies in a company and require it to be accountable to a company's board of directors (IOD, 2009:56; IOD, 2016:55). One of the audit committee's key responsibilities is to keep the board of directors informed regarding the integrity of a company's integrated reporting, and specifically of its *internal financial controls* (IOD, 2009:59; IOD, 2016:55). This assurance of integrity is achieved through the internal audit function's independent assessment of the effectiveness of the company's internal financial controls (IOD, 2009:59; Sarens & Lamboglia, 2014:49; IOD, 2016:56). This interaction between the internal audit function and the audit committee is briefly elaborated on in section 2.4.1.

The Standards (Standard 2130.A1 - Control) also require the internal audit function to evaluate and report on the adequacy and effectiveness of controls in responding to risks, amongst others, regarding the reliability and integrity of *financial* and operational information in an organisation (IIA, 2012a:12). In contrast, the IAASB stipulates that the main objective of the external auditor (as an external assurance provider) is to provide assurance to stakeholders that a company's financial statements are fairly represented and prepared in accordance with an applicable financial reporting framework (IAASB, 2015, ISA 200 par.3). As part of this responsibility they are also required to obtain an understanding of the risks and internal controls as they pertain to the scope of their financial statement audits (Coetzee, 2010:64; IAASB, 2015 ISA 315 par.12). This results in a close working relationship between internal audit and external audit functions, resulting in the internal auditor's view of the financial control environment that may be relied on by the external auditor. This working relationship between internal audit and external audit is further discussed in section 2.4.2.

The next section highlights the internal auditors' involvement in information technology audits.

2.2.4.6 Information technology audits

Section 1.1 made reference to the advances in technology used by organisations and their impact on the day-to-day running of businesses. These technological advances have resulted in increased exposure to information technology-specific risks for organisations (IIA, 2015g:14). This revolution in the operation of business and industry has also resulted in significant changes for the internal audit profession. Consequently, the internal audit function has had to expand its skillset to embrace the execution of information technology audits. These information technology audits can be conducted by the internal audit function itself, or by a dedicated and specialised information systems auditing team that resides in the internal audit function (IIA, 2015a:1). Furthermore, Standard 1210.A3, *Proficiency* together with Standard 2110.A2, *Governance*, also require the internal audit function to include information technology audits as part of delivering on its mandate. In addition, the King III Report (IOD, 2009:85) and COSO (2013:72) also require the board of directors and management to integrate information technology risks into the company's risk management processes. The King IV Report draws attention to the fact that the board of directors is ultimately responsible for all aspects of technology and information systems in the organisation (IOD, 2016:62). To this end, the board of directors and management rely on their organisation's internal audit function to provide them with assurance on all significant risks facing the organisation, including the risks enabled by the presence of information technology (IIA, 2012b:2).

As mentioned in section 2.2.2, the internal audit function's purpose, amongst others, is to assist management with the achievement of their objectives. This includes the independent assessment of an organisation's information technology risks, as was mentioned when discussing the Standards (see earlier). This assessment is conducted through a formal information systems audit. The scope of an information systems audit may include an assessment of the information technology controls that support the business processes, amongst others, and include a review of the organisation's general information systems controls over its technology infrastructures as well as applications, information and people. It may further include an assessment of the controls put in place by management in order to safeguard the confidentiality, integrity and availability of the organisation's information that resides in its computer systems (IIA, 2012a:21; IOD, 2009:87; IOD, 2016:63).

Although the above is not an exhaustive list of all the types of audits that the internal audit function may get involved in, it covers the majority of audits typically performed by internal audit functions. Fundamental to the success of the execution of each of these audits described earlier is the internal audit function's use of appropriate tools and techniques in order to achieve the engagement's set objectives in an effective and efficient manner.

2.2.5 Technology tools and techniques use by internal audit functions

The advances in the use of technology in organisations' business processes (as was mentioned in section 1.1) over the last few decades has put internal audit functions under pressure to adapt to this "new" business environment, which is predominantly driven by technology. An additional pressure on the internal audit function is the rising expectations of its key stakeholders, requiring it to increase its audit coverage in an effective and efficient manner (IIA, 2014:1; PwC, 2014:2; PwC, 2015:17; Tusek, 2015:188). For this reason, the internal audit function has had to find innovative responses to these "pressures" so as to continue to deliver on its mandate as stipulated in the definition of internal audit (refer to section 1.1). The upskilling of internal audit functions and the implementation of technology-based tools as part of their systematic, disciplined approach, was probably one of the most significant responses to these "pressures" (Motubatse *et al*., 2015:269). In other words, business' adoption of technology necessitated the adoption of technology-based tools and techniques by internal audit functions (IIA, 2011:2; Olasanmi, 2013:68; Mahzan & Lymer, 2014:328). In the words of Steve Jobs: *"Technology is nothing. What's important is that you have a faith in people, that they're basically good and smart, and if you give them* ***tools*** *[own emphasis], they'll do wonderful things with them"* (Anonymous n.d.). These words hold true for the CAE: in his or her capacity as the head of the internal audit function to ensure that the function operates in compliance with the Standards. In other words, the CAE should ensure that his or her internal audit function is adequately skilled and able to utilise appropriate tools, technologies and techniques in order to effectively and efficiently deliver on its mandate (IIA, 2012a:19).

Furthermore, the increased pressure on the internal audit function to adopt and/or use technology-based tools is given added impetus by the Standards (Standard 1220.A2, *Due Professional Care*) and by currently recognised best practice guidance for internal audit functions, as stipulated in the King III Report. King III requires the internal audit function to adopt and implement tools and techniques in order to stay abreast of the ever evolving organisational landscape, and especially with regard to an organisation's risk and assurance needs (IOD, 2009:98; IIA, 2012a:6). In the IIA's Research Foundation's (2015a:5), in their 2015 (CBOK) report entitled *Staying a step ahead: Internal audit's use of technology*, it appears that the adoption and implementation of technology-based tools by internal audit functions is increasing, but that there is still room for improvement. The IIA's global survey results (IIA, 2015a:7) list the most prominent technology-based tools currently being used by internal audit functions. These are indicated in Table 2.2.

Table 2.2: Current use of IT tools and techniques by internal audit

TECHNOLOGY-BASED TOOL EMPLOYED BY INTERNAL AUDIT	PERCENTAGE USAGE (INDICATES THE MODERATE TO EXTENSIVE USE AS INDICATED BY THE RESEARCH PARTICIPANTS)
Electronic work papers	72%
A software tool for data mining	53%
An automated tool to monitor and track audit remediation and follow-up	52%
An automated tool for data analytics	52%
Flowchart or process mapping software	52%
Software or an automated tool for internal audit risk assessment	50%
Computer Assisted Audit Technique (CAAT)	48%
An automated tool for internal audit planning and scheduling	46%
Continuous/real-time auditing	44%
Internal quality assessments using an automated tool	37%

(Source: IIA, 2015a:7)

It is also worth noting how the usage of some of these technology-based tools (indicated in Table 2.2) has changed over the 10 year period since the IIA's 2006 CBOK study was conducted. For comparison purposes the five most frequently used technology-based tools identified during the 2006 CBOK study are compared with the equivalent 2015 usages in Table 2.3.

Table 2.3: Increase in internal audit's use of technology-based tools

TECHNOLOGY-BASED TOOL EMPLOYED BY INTERNAL AUDIT	CBOK 2006 PERCENTAGE USAGE (INDICATES THE MODERATE TO EXTENSIVE USE AS INDICATED BY THE RESEARCH PARTICIPANTS)	CBOK 2015 PERCENTAGE USAGE (INDICATES THE MODERATE TO EXTENSIVE USE AS INDICATED BY THE RESEARCH PARTICIPANTS)	PERCENTAGE CHANGE BETWEEN THE CBOK 2006 AND CBOK 2015 STUDIES
Continuous/real-time auditing	37%	44%	Increase of 7%
Computer Assisted Audit Technique (CAAT)	52%	48%	Decrease of 4%
A software tool for data mining	39%	53%	Increase of 14%
Flowchart or process mapping software	43%	52%	Increase of 9%
Electronic work papers	65%	72%	Increase of 7%

(Source: IIA, 2015a:9)

The results presented in Table 2.3 indicate that there has been an overall increase in the use of the most popular technology-based tools over the past 10 years, with the exception of CAATs. This upward trend in the use and implementation of technology-based tools may possibly be an indication that the internal audit function (globally) is actively and positively responding to the pressures it has been under to ensure that its auditing approaches remain relevant and keep pace with the evolvement of technology. A decline of 4% was however noted in the usage of CAATs as a technology-based tool. The reason behind this decline is unclear, but could possibly be linked to an interpretation issue with regard to the broad definition of what CAATs entail (this was suggested in the IIA's 2015 CBOK study). In spite of this decline, increasing the use of CAATs still remains a top priority for internal audit functions. Smidt (2014:152), in his study (as mentioned in section 1.2) on the use of sampling by internal audit functions in the South African banking industry, found that 90% of respondents indicated that the use of CAATs (specifically GAS) could be "utilised more frequently" within their respective departments. This relatively low use of technology-enabled tools was also further accentuated by the IIA's Research Foundation (2016m:6), in their 2016 (CBOK) report on *Regional Reflections: Africa*, where 57% of respondents from South Africa indicated that their internal audit functions only utilise technology "to some extent", or rely solely on manual interventions in the execution of their duties. Another study conducted by Protiviti (2015a:19) in the USA – *From Cybersecurity to Collaboration: Assessing Top priorities for internal audit functions* - confirmed that improving the adoption rate of CAATs remains a top priority for internal audit functions in order to improve the function's skillset in technology-enabled tools and techniques.

Although a number of different technology-based tools are available for internal audit functions' use (as was highlighted in Tables 2.2 and 2.3), these will not form part of the scope of this study. The most popular and frequently used CAAT by internal audit functions is GAS (Kim *et al.,* 2009:215; Lin & Wang, 2011:777; Mahzan & Lymer, 2014:328). It is therefore the intended purpose of this study to assess the use of GAS as a technology-based audit tool (as mentioned in section 1.1). The use of CAATs and specifically the most commonly used CAAT, namely, GAS (as it pertains to the internal audit function) will be discussed in detail in Chapter 3.

2.2.6 The changing landscape for internal audit functions

As John Adair remarked (cited in Ridgers, 2012:33), *"Nothing holds a company back – and the individuals working in it – more than a lack of interest in positive change. You cannot stand still: you either go backwards or forwards".* In other words, if a company is resisting change it becomes static and eventually its products and services are no longer in demand. This holds equally true for the internal audit profession, specifically with reference to its mission which is to enhance and protect organizational value by providing risk-based and objective assurance, advice, and insight (IIA, 2016a). For this reason the internal audit profession must adapt at the speed of the ever evolving technology and risk in order to avoid becoming obsolete and to ensure that it will remain able to achieve its mission.

From the internal audit profession's establishment in 1941 (refer to section 2.2.1) and through its subsequent 75 years of growth and development, change, and fundamental transformation of the profession and the scope of its responsibilities have been inevitable. One of the more significant changes that has occurred, has been the expanded scope of services offered by the internal audit function since its first statement of responsibilities was formally recognised and implemented in 1947 (refer to section 2.2.1). The shift in focus from its original role in the 1940s as a policing function (performing mainly clerical accounting work) to its position today as an independent, objective assurance and consulting activity providing assurance on almost all aspects of the business, is indicative of the "evolutionary road" the profession has followed. Chambers (the current president of the IIA International), has drawn attention to the traditional role of internal audit (which has predominantly been reactionary in nature) and contrasts this with internal audit's present, proactive approach that endeavours to anticipate change (cited in IIA, 2014:1). He goes on to comment that the internal audit function's "value delivery" (as stipulated in its mission) to an organisation is reliant on continuously adapting to and embracing change.

In today's business environment internal audit functions are continuously under the spotlight, being required by members of senior management and the board to explain how the function is adding value to the organisation and to make insightful recommendations that will take the organisation to the next level (Piper, 2015:25). The function is also tasked to provide assurance with respect to the effectiveness of an organisation's risk management, controls and governance processes. It is further expected to be involved in almost all aspects of an organisation, ranging from providing a proactive outlook on business risks (e.g., strategic, compliance, regulatory, financial and operational), to providing value adding recommendations on actions that will mitigate risks before they occur (Kotb, Sangster & Henderson, 2014:46; IIA, 2015g:20; PwC, 2015:6). With specific reference to the banking industry, the Basel Committee on Banking Supervision, in their international guidance document, *The internal audit function in banks,* concurs with this extended scope of responsibilities (or extension of roles) of the function (BIS, 2012:2). It expects the internal audit function to perform a review of all activities of a bank (including outsourced services) and that every branch of the parent bank be included in its scope of responsibilities. It should be clear that the internal audit function is tasked with multiple priorities in delivering on its mandate (as discussed in section 2.2.2). Consequently, the internal audit function has had to reinvent itself repeatedly, to keep up with its various stakeholders' increasingly onerous and complex demands. Table 2.4 provides a brief comparison of the internal audit functions' traditional role with its current (revolutionised) role, thus highlighting the function's transformation. This comparison has been compiled from various internal auditing literature and is thus a useful summary of the process (Deloitte, 2013:3; Hahn, 2015:7; IIA, 2014:1; Kotb *et al.,* 2014:46; KPMG, 2013:4; IIA, 2015c:15; Leech, 2015:48; Piper, 2015:26; Protiviti, 2015b:1; PwC, 2015:6; Shamsuddin *et al.,* 2015:124; Soileau, Soileau & Sumners, 2015:12; Deloitte, 2016c:2).

Table 2.4: The revolutionised role of internal audit

TRADITIONAL ROLE	CURRENT ROLE (REVOLUTIONISED)
Cyclical-based auditing (i.e., recurring year-on-year audits resulting in a static audit plan)	Risk-based auditing (i.e., focus on areas of higher risk resulting in a continuous and evolving audit plan)
Focus on coverage of entire audit universe as depicted on the audit coverage plan	Focus on risk-based audit planning (i.e., focus on areas of higher risk)
End-to-end audits of processes/ business units	Control and transaction-testing based on underlying risk

TRADITIONAL ROLE	CURRENT ROLE (REVOLUTIONISED)
Manual intensive auditing approach	Adoption of automated tools and techniques that allow for a more streamlined and efficient audit approach
Test of controls limited to only a sample of audit populations	Adoption of CAATs and GAS which allows for full population testing
Limited use of data mining on audits	Adoption of technology-based tools that allow for data analytics and data mining
Limited use of technology-based tools	Increased use and adoption of technology-based tools
Reactive approach (i.e., current and backward-looking: reports on past occurrences)	Proactive (i.e., current and forward-looking: expected to provide an overview of emerging risks occurring in the organisational risk landscape)

(Source: own deduction)

Reviewing the information in Table 2.4, a definite paradigm shift is noticeable when comparing the internal audit function's traditional role with its current (revolutionised) role. It is evident that the internal audit function of today follows a more proactive, risk focused approach, embracing the integration of technology-based tools and techniques in order to deliver an efficient and effective assurance role to organisations (refer to section 2.2.5). As mentioned in section 1.1, the business landscape of today is driven by technology and it is therefore not surprising to note the adoption and integration of technology-based tools in the current role and audit methodology of internal audit functions. Chapter 3 provides a detailed discussion on the adoption of CAATs (and specifically GAS) by internal audit functions in the execution of their duties.

2.3 A BRIEF OVERVIEW OF THE INSTITUTE OF INTERNAL AUDITORS

The IIA, with its head office in Altamonte Springs, Florida in the USA, is the profession's global representative organisation (IIA, 2016k). The institute was formally established in 1941 and has grown steadily to the point where it is now recognised as the internal audit profession's global voice, through its authoritative publications, qualifications, and advocacy efforts (IIA, 2016k).

Victor Z. Brink is credited with authorship of the first textbook specifically on internal auditing, in 1941, which was coincidentally the same year in which John B. Thurston and Robert B. Milne turned their common interest in promoting internal audit into the Institute of Internal Auditors. On 9 December 1941 in New York City, the 24 founding members of the IIA elected John B Thurston the institute's first president (IIA, 2016k).

The IIA was a success from the its inception, with membership reaching 1018 individuals within the first five years (IIA, 2016k). By 1957, the IIA had become a global professional body: of its 3700 members, 740 were from countries outside the Unites States of America (IIA, 2016k). Now, sixteen years into the twenty-first Century, global membership exceeds 180 000, and is drawn from 120 countries on all continents. South African internal auditors support, and are supported by an active regional IIA Chapter which provides technical guidance, training and certification programs for its members and the academic community (IIA (SA), 2016l).

The IIA (as does any professional organisation) continuously promotes the internal auditing profession in accordance with their mission statement (IIA, 2016k). The IIA's mission is:

- to sponsor and promote the value internal audit professionals add to their companies;
- to provide a wide range of professional educational and development opportunities, standards and other professional practice guidance, and certification programs;

- to research, circulate and encourage knowledge concerning internal auditing and its appropriate role in control, risk management, and governance to practitioners and stakeholders;
- to train practitioners and other relevant parties on best practices in internal auditing; and
- bringing together internal auditors from all countries, to share information and experiences.

In addition to providing its members with technical guidance, training, and certification programs, the IIA also researches and publishes “mandatory” and “strongly recommended” guidance. These guidance documents form part of the IPPF, an internationally relevant reference and guidance source for individual internal auditors and internal audit functions in pursuit of fulfilling their professional duties (IIA, 2016b).

2.3.1 The International Professional Practices Framework

Given that internal audit is an internationally recognised and represented profession, and that economic globalisation is a well-established condition, there is a need for globally relevant guidelines that enable audit results to be consistent, replicable and generated in a manner that demonstrates the independence and ethics of the function, regardless of the geographies of the entities. This has led the IIA to develop and publish their International Professional Practices Framework, the IPPF, which provides guidance to internal auditors on pertinent issues ranging from ethical behaviour to preferred approaches to specific auditing situations. The guidance addresses both departmental matters and those affecting the individual internal auditor. In short, the IPPF is the IIA’s guidance and reference framework for all aspects of internal audit, for the global internal audit profession (Sobel, 2015:22; IIA, 2016b). In other words, it can be seen as the compass that provides the internal audit function with direction so that its efforts keep pace with global economic change. The evolvement of today’s organisational risk landscape, changing stakeholder expectations, legislative and regulatory demands for improved governance, risk management and internal control has a direct impact on the internal audit function and its ability to deliver on its mandate (as was highlighted in section 2.2.2) (IIA, 2015b). These evolvements have necessitated that the IIA frequently revisits the current IPPF with the intention of ensuring that it remains relevant. Consequently, the latest revision of the IPPF came into effect on 6 July 2015. It includes two significant enhancements, namely, the introduction of a *Mission Statement* for the internal audit function, as well as requiring the implementation of *10 Core Principals for the Professional Practice of Internal Auditing* (IIA, 2015b).

There are two levels of guidance in the IPPF. “Mandatory guidance” comprises protocols, techniques and processes that must be employed in the performance of an internal audit engagement. Failure to comply may result in a formal investigation and ultimately in termination of membership of the IIA. The “recommended guidance” allows the internal audit practitioner some latitude in how (or whether), to implement the recommendations (IIA, 2016b). The mandatory guidance component of the IPPF consists of:

(1) core Principles for the Professional Practice of Internal Auditing;
(2) the definition of internal auditing;
(3) the IIA’s Code of Ethics; and
(4) the Standards (IIA, 2016b).

The Principles provide the foundation, describing what effective internal auditing entails. It requires that the individual internal auditor, as well as the internal audit function, complies with the following:

- *“Demonstrates integrity;*
- *Demonstrates competence and due professional care;*
- *Is objective and free from undue influence (independent);*
- *Aligns with the strategies, objectives, and risks of the organization;*
- *Is appropriately positioned and adequately resourced;*
- *Demonstrates quality and continuous improvement;*
- *Communicates effectively;*
- *Provides risk-based assurance;*

- *Is insightful, proactive, and future-focused; and*
- *Promotes organizational improvement”* (IIA, 2016c).

The definition of internal auditing (refer to section 1.1) sets out the internal audit function’s responsibilities and duties within the organisation (IIA, 2016d) whereas the internal audit function’s mission statement defines what the function intends to achieve (IIA, 2016a). The Code of Ethics defines what is appropriate behaviour on the part of individual internal auditors and companies conducting internal audit-related work (IIA, 2016e). Failure to comply with the Code of Ethics may lead to an investigation into the conduct of an IIA member, the consequences of which may include disciplinary measures and suspension of membership privileges. The Standards describe the nature of internal audit (its principles, procedures, and checks and balances), and how individuals and companies performing internal audit related work are expected to perform (IIA, 2016f).

The IIA issued its first set of Standards in 1978 (Gupta, 1991:139; Ramamoorti, 2003:6; O’Regan, 2001:219; Chapman, 2004:40; Chambers, 2015:35). The version of the Standards currently in force came into effect on 1 January 2013 (IIA, 2016f). The Standards outline the basic principles for the international practice of internal auditing. Within its structure, there is a framework for performing internal auditing, for improving the practice of internal audit, and the assessment criteria for evaluating the performance of an internal audit function. In addition, it encourages internal audit functions to improve the quality of their work (IIA, 2016g). The Standards come in two variants: attribute and performance standards (IIA, 2016g). The attribute standards set out the characteristics and responsibilities of a company’s internal audit function, and those of the individuals involved in the performance of the internal audits (IIA, 2016g). The performance standards guide the practice of internal auditing, and provide the criteria against which the internal audit function’s performance can be assessed (IIA, 2016g). The Standards are equally applicable to the individual internal auditor and the internal audit function (IIA, 2016g).

The “recommended guidance” section of the IPPF consists of implementation guidance (practice advisories) and supplemental guidance (practice guides). It provides direction to internal auditors and internal audit functions to ensure the effective implementation of the core principles for the professional practice of internal auditing, the definition of internal auditing, the code of ethics and the Standards (Baker, 2009a:55; Beran, 2011:56; IIA, 2016h). The implementation guidance and practice advisories are specifically intended to provide support to internal auditors in their efforts to apply the Standards correctly and consistently in the execution of their duties (IIA, 2016i). The supplemental guidance (practice guides) are essentially practical, providing in-depth guidance to internal auditors for the performance of internal auditing work. These include topical areas and sector-specific issues, as well as processes and procedures, tools and techniques, programs, step-by-step approaches, and examples of deliverables (IIA, 2016j).

The mandatory requirements contained in the IPPF, if complied with, enable internal audit functions to be effective and to be independent assurance and consulting services providers to their organisations' internal operations. The quality of the independent assurance and consulting services is directly correlated with the quality of the relationships between the internal audit function and the board's audit committee and the external audit function. This relationship will be discussed in section 2.4.

2.4 INTERNAL AUDIT'S RELATIONSHIP WITH THE AUDIT COMMITTEE AND EXTERNAL AUDIT

2.4.1 Internal audit's relationship with the audit committee

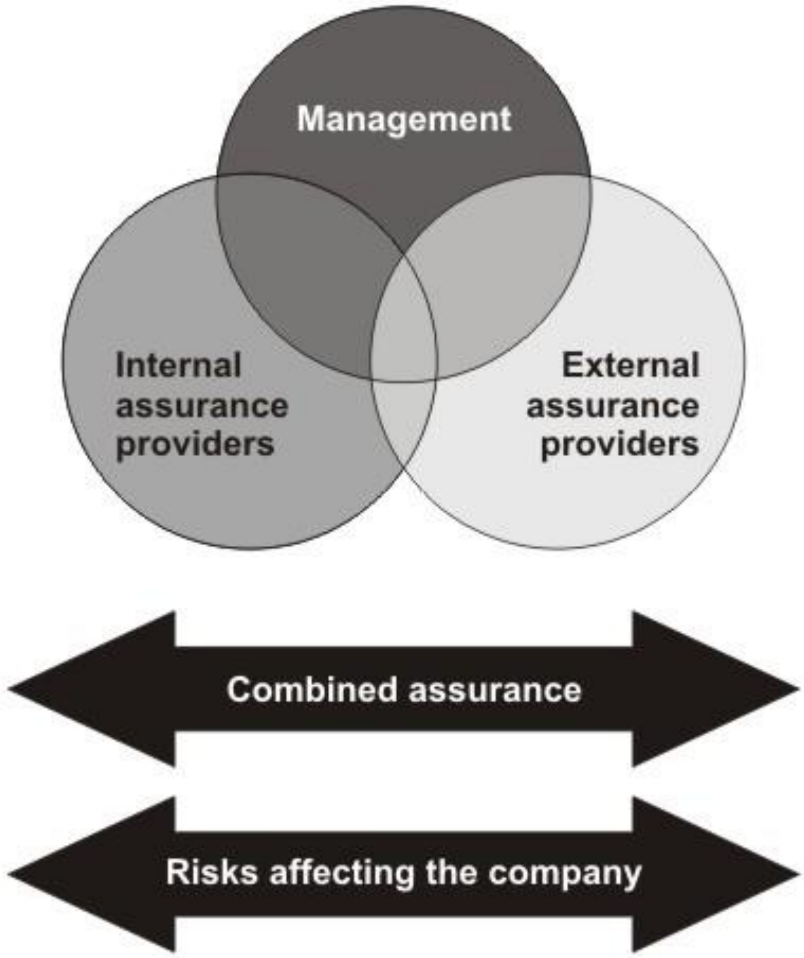
The board of directors of an organisation needs to prioritise their time in order to maximise the value of their respective organisations, which is achieved by overseeing the organisational strategy and management in ensuring the achievement of an organisation's objectives (refer to section 1.1). In other words, they need to be satisfied that mitigating actions are implemented by management that are appropriate to combat current and/or emerging risks that might otherwise negatively impact the achievement of an organisation's objectives (Deloitte, 2016a:1). For this reason, the internal audit function (through its independent assessment of an organisation's risk management, governance and internal control) is an invaluable resource to an organisation's board of directors and/or its audit committee (IIA, 2015f:13; Tusek, 2015:187). The audit committee (with delegated authority from the board of directors), has oversight of the internal audit function's performance, who's responsibility is to provide objective assessments of the effectiveness and efficiency of risk management, controls and governance processes in the organisation (Marx, 2008:295; BIS, 2012:21; Hahn, 2015:7; PwC, 2015:6). A key aspect of the audit committee's role is to protect the internal audit function's independence from undue influence from management. In so doing, the quality, credibility and reliability of internal audit's work is enhanced (Marx, 2008:289; IOD, 2009:63; FSB, 2013:18; IOD, 2016:69). Its governance role is to provide oversight of financial reporting, risk management, internal control, compliance, and ethics, while ensuring effective and efficient co-operation between the entity's management and its internal and external auditors (FSB, 2013:31; BIS, 2015a:16; IIA, 2015e:3; KPMG, 2016:1). According to the King III and King IV Reports, a company's audit committee is required to oversee the internal audit function (IOD, 2009:63; IOD, 2016:69). This is mirrored in the Basel Committee's corporate governance principles for banks (BIS, 2015a:16). The audit committee's effective oversight should result in appropriately prepared and conducted internal audits, and in adequate and effective implementation of the internal audit function's recommendations and findings by the affected members of the management team (Marx, 2008:292; FSB, 2013:18; BIS, 2015a:17).

Given the internal audit function's unique position within an organisation (both functionally and in terms of its reporting lines), it is clear that it is the internal audit function's responsibility to inform the audit committee on the manner in which identified risks are being addressed. In addition, any new risks that could prevent a company from achieving its strategic and operational objectives should immediately be communicated to the audit committee (FSB, 2013:24; Alzeban, 2015:546; Mungal & Slippers, 2015:61). The King III and King IV Reports (IOD, 2009:63; IOD, 2016:70), the Basel Committee (BIS, 2015a:16-17), and the FSB (2013:31) regard the audit committee as being responsible for the following issues as they relate to the internal audit function:

- to ensure the independence of the internal audit function;
- to ensure the internal audit function has adequate budget and resources to fulfil its duties;
- the approval of the internal audit plan;
- the appointment, performance assessment and dismissal of the CAE;
- to coordinate efforts of and ensure cooperation between the external and internal auditors in order to minimise duplication of audit efforts; and
- to ensure the quality of the internal audit function's output through independent quality reviews.

While internal audit is a valuable resource, providing an organisation's executive management, audit committee and other stakeholders with insights (refer to section 2.3.1 for the internal audit function's mission statement which includes the provision of "insight" to its key stakeholders) that assist them to achieve their business objectives (particularly through the improvement of internal controls and overall governance) it is not the only provider of independent assurance to an organisation. Thus, the plans of all internal and external assurance providers should be coordinated to minimise duplication of their efforts (IIA, 2012a:10, Standard 2050; IAASB, 2015 ISA 610 par.15). This co-ordinated interaction between a company's assurance providers is referred to as combined assurance, and is another of the audit committee's responsibilities (IOD, 2009:62; IOD, 2016:69). Both the King III and the King IV Reports and various other reports emanating from the global auditing firms, all emphasise the importance of combined assurance. It requires a close working relationship between management and the internal and external assurance providers to ensure that all the risks affecting an organisation are identified and mitigated (IOD, 2009:62; KPMG, 2015a:4; PwC 2015:14; IOD, 2016:68). In addition, the IIA in its global report, *Combined Assurance: One Language, One Voice, One View* (IIA, 2015e:1) also points out that effective combined assurance can contribute positively in minimising management's "assurance fatigue" as a result of the recurring attentions of all the various assurance providers in an organisation. Combined assurance can provide an integrated and holistic view of the effectiveness of an organisation's governance, risk mitigation efforts and controls. This should enable senior management and the respective oversight committees to prioritise their efforts accordingly. Figure 2.1 illustrates the working relationship between these assurance providers within a company.

The objective of the combined assurance approach (as mentioned earlier) is to minimise duplication of efforts and to prevent omissions so that the significant risk areas of an organisation are identified and adequately addressed. A prerequisite of the combined assurance approach is that the two key assurance providers (internal audit and external audit) interact more effectively to ensure that their individual reports are mutually supportive and reliable. To do this requires co-ordinated planning sessions.



(Source: IOD, 2009:62)

Figure 2.1: Working relationship between assurance providers

2.4.2 Internal audit's relationship with the external auditors

Globally, there is an increasing emphasis on corporate governance and this is compelling improvements in the relationship between internal audit and external audit functions (Glover, Prawitt & Wood, 2008:193; Schneider, 2009:41; Paino, Razali & Jabar, 2015:154; Turpen & Dyer, 2015:17). In addition, section 2.2.5 has highlighted the internal audit function's paradigm shift toward technology-enabled auditing. The study conducted by Malaescu and Sutton (2015:107), found that external auditors tend to place increased reliance on the work of internal audit when the internal audit function has made use of technology-enabled auditing (such as continuous auditing) in the conduct of its duties. The King III and King IV Reports both recognise the external auditors as members of a company's team of external assurance providers (IOD, 2009:62; IOD, 2016:68). As was mentioned in section 2.2.4, the external auditors' main objective is to provide assurance to stakeholders that the company's financial statements fairly represent its situation and that they are prepared in accordance with an appropriate financial reporting framework (IAASB, 2015 ISA 200 par.3). On the other hand, the internal auditors' objective is to provide management with an objective assessment of the effectiveness and adequacy of the company's risk management efforts, control and governance processes (IIA, 2012a:21). Both audit functions share the objective of assisting the company's board and management team in their efforts to achieve the company's objectives (BIS, 2015d:22).

It is clear from the earlier discussion that the external auditors are primarily concerned with financial audits, where they investigate financial transactions, balances, et cetera. However, the external auditor must also obtain an understanding of the risks and internal controls as they pertain to the scope of their audit (Coetzee, 2010:64; IAASB, 2015 ISA 315 par.12). As both internal and external auditors have a common focus on risks and internal controls, and despite their differing objectives, the probability of duplication of effort arises. External auditors therefore may decide, as a matter of routine, to rely on the control testing work performed by internal audit in order to avoid duplication of effort. This reliance on the work of the internal auditors by external auditors is allowed in terms of the Professional Auditing Standards, provided that an assessment of the internal audit function has been made prior to placing such reliance on their work (IAASB, 2015 ISA 610 par.15). In the process of determining whether they can rely on the work of the internal auditors, the external auditors consider the following three key factors (IAASB, 2015 ISA 610 par.15):

- internal audit's objectivity with regard to its status and reporting lines;
- technical competence of the internal audit staff; and
- whether the internal audit function follows a systematic, disciplined approach in the execution of its duties, including quality assurance.

With specific reference to the criterion above regarding the internal audit function's systematic, disciplined approach and quality assurance, it is important for internal audit functions to demonstrate adherence to the mandatory requirements (refer to section 2.3.1) of the IPPF (i.e., the core principles for the professional practice of internal auditing; the definition of internal auditing; the IIA's Code of Ethics and the Standards). Internal audit functions can satisfy this requirement through an effective quality assurance and improvement program as required by Standard 1300, *Quality Assurance and Improvement Program* (IIA, 2012a:7; Turpen & Dyer, 2015:17). Furthermore, Standard 2050, *Coordination*, similarly, encourages internal auditors to coordinate their efforts with those of the other internal and external assurance providers, in order to minimise duplication of effort (IIA, 2012a:10).

It is clear from the above that effective and efficient integration of efforts and the open and accurate communication between the two major assurance providers should result in an improvement of the quality of the audits, and an increase in the value both audit functions add to the business, regardless of industry. At this point, it should be noted that all banks are required to have internal audit functions tasked with the evaluation of the internal (operational) activities of a bank (South Africa, 2007a, sec.48; BIS, 2012:2).

2.5 A BRIEF OVERVIEW OF THE BANKING INDUSTRY

2.5.1 An international perspective

The Group of Twenty (G-20), the FSB and the Basel Committee are the key contributors to the formulation of the standards that regulate the global banking industry. The G-20 comprises finance ministers and central bank governors of the following countries: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Republic of Korea, Russia, Saudi Arabia, South Africa, Turkey, the UK, the United States and the European Union (EU) (G-20, 2016a). One of the G20's main aims, is to strengthen economic growth and investment and to maintain financial stability (G-20, 2016b). The FSB has similar objectives, seeking to develop and implement effective regulatory, supervisory and other financial sector policies that will strengthen financial systems and the stability of international financial markets (FSB, 2016a). The membership of the FSB includes:

- national authorities responsible for financial stability in significant international financial centres;
- international financial institutions;
- sector-specific international groupings of regulators and supervisors; and
- committees of central bank experts (FSB, 2016b).

The Basel Committee's objective is to strengthen the quality of bank supervision across the world by developing guidance and advice on regulatory issues (BIS, n.d.). The collapse of the United States' sub-prime mortgage market was a key component of the international financial crisis that started in 2007 (as discussed in section 1.1), that also resulted in a number of other bank failures. Consequently, there was a significant loss of confidence in the banking industry, weakening its reputation in the eyes of the general public and the world's stock markets (EY, 2013(a):5). The consequences of this crisis continue for the banking industry, manifest as ongoing scrutiny by investors, the public and the banking industry's supervisors. One of the key outcomes of the international financial crisis has been the number of new or amended regulatory and supervisory standards that have been issued in ongoing efforts to mitigate the weaknesses identified by the crisis. The G-20, the FSB and the Basel Committee have all expended significant effort (post-financial crisis) developing strategies and action plans intended to prevent the reoccurrence of similar financial crises (Reserve Bank, 2015:1). Since its establishment on November 2008, following the international financial crisis, the Leaders' Summit of the G 20 has already convened ten times (G-20, 2016c). Arising from these meetings, the G-20 leaders have agreed to an action plan, and have undertaken to implement strategies to stabilise the global economy and to prevent future financial crises. In similar vein, the FSB has updated its international standard, identified as *"Key Attributes of Effective Resolution Regimes for Financial Institutions"*. The South African banking industry has also agreed to comply with this standard, acknowledging that it demands continuous effort to adopt and adhere to these requirements in order to build a viable and sustainable banking industry (FSB, 2014:5; Reserve Bank, 2015:34). In an effort to reduce the impact of the crisis, and to prevent its reoccurrence, the Basel Committee has also issued various documents and requirements to guide the global banking industry in this regard. A summary of the key matters already communicated is listed below:

- a leverage ratio framework and disclosure requirements;
- guidance for supervisors on market-based indicators of liquidity;
- disclosures related to the liquidity coverage ratio (LCR);
- restricted version of committed liquidity facilities (CLFs);
- risk management guidelines related to anti-money laundering and terrorist financing;
- fundamental elements of banks' capital planning processes;
- the standardised approach for measuring counterparty credit risk exposures;
- external audits of banks;
- exposures to central counterparties;
- measuring and controlling large exposures;
- frequently asked questions on the Basel III framework's LCR;
- principles for effective supervisory colleges;
- principles for the sound management of operational risk;
- frequently asked questions on the Basel III leverage ratio framework;

- the net stable funding ratio (NSFR); and
- revisions to the securitisation framework (Reserve Bank, 2015:54).

Despite the good intentions contained in these publications, the situation within and surrounding the international banking industry remains “problematic” and “challenging”: the efforts of the G-20, the FSB and the Basel Committee have still not fully restored the reputation and stability of the banking industry. Events that epitomise the ongoing nature of the crisis include the resignation of Barclays Bank’s CEO in 2012. This was in response to the finding that Barclays Bank’s employees had actively manipulated the Libor rate, the rate at which banks lend money to each other (Barnes, 2012; Lee, 2012a). Shortly thereafter, JP Morgan was discovered to have overstated its 2012 first quarter nett income by $459 million, another significantly negative event as far as the global banking industry’s reputation was concerned (Lee, 2012a; Rosner, 2013). One of HSBC’s subsidiaries was implicated in money laundering schemes, further tarnishing the global banking industry’s reputation (Goodway, 2012:39; Lee, 2012a). In addition, the public’s faith in an “ethical and trustworthy” banking system was furthered tarnished when four of the world’s largest banks (Citigroup, JP Morgan Chase, Barclays and Royal Bank of Scotland) pleaded guilty to charges of manipulating foreign exchange rate markets. This resulted in a total penalty fee payable of over $2.5 billion by these banks (Corkery & Protess, 2015). In a recent survey conducted by the Centre for the Study of Financial Innovation (CSFI), it was noted that one of the top 10 risks currently facing the global banking industry is that of “conduct practices” (refer to Table 2.5) (CSFI, 2015a:5). This risk refers to the damage that will be caused to banks as a result of unethical business practices (CSFI, 2015a:20). These bank scandals, together with those mentioned in section 1.1, have occurred largely because of their poor lending policies and ineffective governance practices. On the other hand, Lubbe (2009) identifies another pair of factors contributing to the international financial crisis: “dishonesty” and a “lack of transparency” in decision-making and reporting on the part of political and business leaders in the USA and elsewhere on the actual state of the world economy. It therefore comes as no surprise to see the risk of “conduct practices” being emphasised as a material threat to the reputation and sustainability of the global banking industry. That the global banking industry will remain subject to strict supervisory regulations by international standard setting bodies and national central banks for the foreseeable future should be expected, as the banking industry and national governments continue their efforts to restore financial stability and their reputations.

Banks serve as holders (custodians) of the savings deposited by members of the public. Perhaps more importantly, they provide and manage the channels needed to effect secure and efficient payment for goods and services, and finance the development of businesses and large-scale infrastructure projects, amongst others (BIS, 2015a:3). They are thus significant contributors to and facilitators of a country's economic growth and financial stability (Mosharrafa, 2015:43). But, like all commercial ventures, the banking industry can only survive if they can retain the confidence of the public – their customers – which is largely dependent on the successful outcomes of their financial and operational performances (Reserve Bank, 2015:20; EY, 2015:2). Ultimately, the banking industry will remain viable, and will reclaim the publics' trust and confidence, through employing appropriate and effective corporate governance practices (Mosharrafa, 2015:43; BIS, 2015a:3). The converse is also true: poor corporate governance practices may continue to result in bank scandals and consequently a low confidence in the banking industry by members of the public. In order to restore their individual reputations and that of the global banking industry they have to increase their diligence in the conduct of their duties, and their vigilance so that they are able to anticipate economic developments and pre-emptively address emerging risks.

The global banking industry is an integral part of the still fragile global economy. The truth of this is borne out by the fact that the CSFI global banking risk survey placed macro-economic risk (refer to Table 2.5) in top position (risk 1) (CSFI, 2015a:5). This is indicative of the global banking industry's concern about the weakness of the global economic recovery. Substantiating factors for this emphasis on the macro-economic environment as the number one risk can be seen in the high levels of debt in all main sectors around the world (sovereign, corporate and consumer), future interest rates and the weaknesses experienced by China's economy including other emerging markets (CSFI, 2015a:2). Furthermore, increased regulation and an economic era of low growth rates will have a significant impact on banks' profitability in the foreseeable future (CSFI, 2015a:12; EY, 2015:2). Table 2.5 lists the top ten risks identified in the 2015 CSFI global banking risk survey:

Table 2.5: Top 10 risks facing the global banking industry

RISK RANKING	RISK
1	Macro-Economic environment
2	Criminality
3	Regulation
4	Technology risk
5	Political interference
6	Quality of risk management
7	Credit risk
8	Conduct practices
9	Pricing of risk
10	Business model

(Source: CSFI, 2015a:5)

The global financial crisis of 2007/2008 changed the world's economy and in so doing brought to top of mind the risk of bank failures internationally. In addition, the risk landscape in which the banking industry operates is evolving rapidly, and banks have to be prepared and able to take pro-active initiatives regarding emerging risks in order to ensure that they achieve their set objectives. One such emerging risk that poses a significant threat to banks is cyber-crime. This is especially so as the volumes of electronic data processed and stored by banks is escalating on a daily basis. This is seen as the main contributor for the assessment of criminality (the risk to banks in areas such as money laundering, tax evasion and cyber-attacks) as the second highest risk (risk 2) currently faced by the global banking industry (CSFI, 2015a:13). Closely linked to this is technology risk (the risk that banks will fail to stay up to date with technological change), which is the fourth-ranked risk (risk 4) on the global banking industry's risk landscape. The IIA, in their global study (conducted in 2015) entitled *Navigating Technology's Top 10 Risks*, also affirms that cybersecurity is the number one technology risk that organisations and internal auditors are currently focused on (IIA, 2015i:5). In another global study, this time conducted by ISACA and Protiviti, entitled *A Global Look at IT Audit Best Practices*, cybersecurity was also cited as one of the main technology-based risks facing organisations' IT risk universes (ISACA & Protiviti, 2015:4).

The introduction of stricter regulations (risk 3) by regulators of the banking industry and political interference in a bank's management and lending practices (risk 5) should strengthen the banking industry; and although some of these challenges have been embraced by the banks, concerns are still being raised regarding the costs of and benefits that will be derived from this. In support of the increases in banking industry regulation as a global initiative, the IIA, in another of their global studies *(A Global view of Financial Services Auditing)* also confirmed that regulatory challenges are seen as one of the top concerns for internal audit functions in the financial services industry (IIA, 2015g:6). Despite of stricter regulations and political interference (intended to improve the banking industry) there is still concern regarding banks' quality of risk management (risk 6) (CSFI, 2015a:19). The international financial crisis focused world attention on the banking industry, and in particular on its risk governance practices. The area of risk management assurance and effectiveness was also one of the key risks that warrants attention by internal auditors in the financial services industry, as was revealed by the IIA's global study on the financial services industry (IIA, 2015g:6). The fact that the Libor and foreign exchange rates were manipulated by four of the world's largest banks (as mentioned earlier) is a further indication of the state of risk management functions in these banks (CSFI, 2015a:18). The risk management function of a bank is required to identify, measure, mitigate and report to the senior management and the board on the bank's risk exposures (BIS, 2015a:25). It is important, in order to avoid accusations of bias, that the risk management function and the business units whose activities are subject to risk identification and monitoring/evaluation, are independent. In addition, the effectiveness of a risk management function correlates positively with the availability of resources (including appropriately trained staff), necessary to fulfil its risk management responsibilities to the board (BIS, 2015a:25).

Credit risk (risk 7) is the risk that banks may experience losses as a result of lending to sovereign borrowers and consumers. This was also a concern highlighted by the global banking industry and is mainly attributed to an increase in borrowers' indebtedness to the point where they default on repayments to the respective banks (CSFI, 2015a:19).

The risk of damage that may be caused to banks as a result of unethical business practices (risk 8) manifested in a number of bank scandals that was mentioned earlier (also refer to section 1.1) (CSFI, 2015a:20). In addition, the Bank for International Settlements highlights ethical behaviour as one of the key components needed for good governance (BIS, 2015a:9). Furthermore, banks need to ensure that they are aware of the impact that the realisation of a potential risk may have on them and should not be "blinded" by factors such as competition, a strong liquidity position and low interest rates. These factors may lead to banks taking on more risk without first determining the cost and true impact of that risk should it materialise. Thus, the pricing of risk (risk 9) is also recognised as one of the top risks faced by the global banking industry (CSFI, 2015a:20). In challenging economic times that are coupled with excessive regulatory reforms and increased customer demands, it can no longer be "business as usual" for the banking industry. Innovative adjustments to current business models and organisational structures will be essential if they are to remain competitive (EY, 2015:34). It therefore comes as no surprise to see business model risk (risk 10) as a major concern facing the global banking industry (CSFI, 2015a:21).

2.5.2 The banking industry within South Africa

The South African Reserve Bank (South Africa's central bank), regulates and supervises the country's banking industry through its Bank Supervision Department (Reserve Bank, n.d.(a)) (also refer to section 1.1). Its purpose is to ensure that the banking system is robust and efficient, so that the interests of depositors are protected, and so that the overall financial stability of the country is maintained (Reserve Bank, n.d.(a)). The Supervisor plays an important role in the local banking industry, monitoring the controls and financial conditions within local banks to ensure good banking practices, and enforcing the local banking industry's regulatory requirements.

According to the Reserve Bank, it is because of the unique nature of the business of a bank, and its importance within the economy, that it is necessary to implement strict official supervisory control (Reserve Bank, n.d.(a)). Supervision of the local banking industry benefits the economy in a number of ways. **Firstly,** having an effective banking system in South Africa enables the monetary authorities to use their data with greater certainty when making decisions regarding money supply and interest rates (Reserve Bank, n.d.(c):2). **Secondly,** there are significant risks associated with the taking of deposits and the granting of loans (made up of those deposits together with other funds) to individuals and businesses, at a profit (Reserve Bank, n.d.(c):2). The bank takes on a liability to repay the deposits taken from the public, in full and with interest, on demand. What is decidedly less certain is whether the borrowers of these deposits and funds will be able to repay the bank according to the terms of the agreement. Thus, in order to assist the depositor citizens of the country mitigate their risks with respect to their deposits, the Supervisor effectively has the authority to manage/oversee the country's banking industry (Reserve Bank, n.d.(c):2). A **third** justification for the Reserve Bank's supervision of the banking industry is the fact that when depositors place money with a specific bank to earn interest on that money they are not aware of all the risks and threats that the specific bank might be facing. Thus, they are not able to determine whether the reward (interest rate) they have been offered by the bank is commensurate with the risk they are taking by making that deposit or investment (Reserve Bank, n.d.(c):2). A **fourth** aspect of bank supervision is to discourage misrepresentation of the nature of the business, and the misappropriation of the illegally obtained deposits (Reserve Bank, n.d.(c):2). The Supervisor has the task of ensuring the long-term sustainability of the local banking industry, and improving the industry's collective risk management efforts is an area of emphasis (Reserve Bank, n.d.(c):2). By promoting effective risk management and corporate governance within South African banks the Supervisor's intention is to facilitate the sustainability of banks and through them the economy as a whole. By its efforts to maintain the banking industry's focus on risk management and effective governance, it is hoped that the local banking industry will be well prepared for possible future international financial crises similar to that which occurred in 2007/2008.

While the 2007/2008 international financial crisis resulted in a number of bank failures in the USA and the UK (refer to section 1.1 and 2.5.1), South Africa's banking industry was relatively unaffected. Various authors have attributed this to the South African banking industry's strong governance and regulatory framework (Donohoe, 2009:53; Fitch Ratings, 2013:2). Despite the relatively low impact of the international financial crisis on the local banking industry, the situation nevertheless prompted the Supervisor to take note of the primary causes of the crisis, and to review its local supervisory and regulatory framework (Reserve Bank, 2011:1). A comprehensive regulatory and supervisory framework for banks creates a strong foundation for a sustainable banking system (Reserve Bank, 2015:1). Thus the revised supervisory framework incorporated the Basel II framework's enhancements (effective 1 January 2012), and the *29 Core Principles for Effective Banking Supervision* (Reserve Bank, n.d. (a); BIS, 2015b:4). In addition, the framework also incorporated the Basel III framework's regulations which became effective on 1 January 2013 (Reserve Bank, 2011:1). The Supervisor also participates in and contributes to international forums that address bank supervisory and regulatory matters, including the G-20, FSB and the Basel Committee meetings (Reserve Bank, n.d. (a); Reserve Bank, 2015:1), and is thus able to stay abreast of international developments within the banking industry. This ensures that the South African banking industry is kept apprised of events or emerging risks that might destabilise the local banking industry. In response to the recent global CSFI banking risk survey (as mentioned in section 2.5.1), the specific risks facing the South African banking industry were also identified (CSFI, 2015b).

The concerns identified by the South African Banking industry were closely aligned to those of the global banking industry. In other words, six of the top 10 risks raised by the global banking industry also formed part of the top 10 risks raised by the local banking industry. These were the macro-economic environment, regulation, criminality, credit risk, technology risk and political interference. Of particular concern to the local banking industry was the risk associated with emerging markets, interest rates, currency and human resources (CSFI, 2015b). Macro-economic risk (identified as the global number one risk) is justifiably also the major concern of the South African banking industry (refer to section 2.5.1): the state of the global economy is characterised by rising Euro sovereign debt and the possibility of a new liquidity crunch, amongst other challenges. In addition, the weakening of South Africa's sovereign debt position, coupled with ongoing under-delivery on infrastructure projects, a weakening currency, labour unrest, protests and poor leadership are indicative of a deteriorating economic environment (CSFI, 2015b). The downgrade of South Africa's banks (with special emphasis on the failure of African bank in August 2014 as mentioned in section 1.1) by Moody's, the international credit rating agency, was a further factor confirming the weakening economy and loss of confidence in the reputation of the South African banking industry (the banks failed particularly in compliance requirements) (IRMSA, 2015:15). Confidence in the South African banking industry was further undermined by the removal of the Finance Minister (Mr. Nhlanhla Nene) in December 2015, an action that resulted in a loss of R130 billion in the market value of the South African bank index (Bonorchis & Kew, 2015; Letsoalo, 2015). Another series of events that undermined trust in the South African economy (both by local and foreign investors) were associated with the report released by the Public Protector on 3 November 2016 (Smith, 2016). As a positive counter-balance in this series of events, the South African banking industry demonstrated strong corporate values when some of its major banks (FNB, Absa, Standard Bank and Nedbank) decided to cut ties with the Gupta family's business affairs in April 2016, as there were indications that they were involved in ongoing high-level political manipulations (known locally as "state capture") for personal gain (Writer, 2016). The South African banking industry is required to comply with the strong regulatory requirements (as discussed earlier) and to fulfil its anti-money laundering obligations. The decision by these major South African banks to cut ties with the Gupta family-owned and controlled entities, in an effort to ensure that they complied with all local and international regulatory requirements and guidelines, should contribute to restoring trust and confidence in the South African banking industry.

Other major concerns to the South African banking industry identified include the weakening of South Africa's currency, which adds pressure arising from imported inflation, which inevitably results in increases in interest rates: this then puts further constraints on households' abilities to address their already high indebtedness, which in turn increases the likelihood of defaults on repayments to the banks. The survey also highlighted the human resource constraints, with specific reference to banks' ability to attract and retain essential skills within the banking sector (CSFI, 2015b).

Another major concern (although ranked as risk 11) facing the local banking industry was that of liquidity risk (CSFI, 2015b; EY, 2015:18).

The liquidity risk faced by banks, especially during the global banking crises of 2007/2008, prompted the Basel Committee to issue new regulatory requirements to address liquidity risk. These regulations contained two new liquidity ratios - the Liquidity Coverage Ratio (LCR) (a short-term metric), and the Net Stable Funding Ratio (NSFR) (a longer-term metric) (BIS, 2013:1). The objective of the LCR is to identify whether banks hold sufficient qualifying liquid assets to cover all net cash outflows under a stress scenario for a period of 30 days (BIS, 2013:1). The Basel III regulatory requirement was set out to gradually achieve the required LCR over a period of five years. The minimum LCRs to be achieved by all registered and active banks globally are set out as follows:

- a minimum LCR of 60% must have been achieved by 1 January 2015;
- a minimum LCR of 70% must have been achieved by 1 January 2016;
- a minimum LCR of 80% to be achieved by 1 January 2017;
- a minimum LCR of 90% to be achieved by 1 January 2018; and
- a minimum LCR of 100% to be achieved by 1 January 2019 (BIS, 2013:2).

On the other hand, the NSFR assesses whether banks are able to fund assets maturing after one year from stable sources of funding (BIS, 2013:1). Compliance with these stricter liquidity requirements will be especially challenging for those banks that rely heavily on short-term funding to maintain liquidity, or that have inferior quality liquid assets (KPMG, 2012(b):3). Adjusting to these new requirements will incur additional costs as investment and financing strategies have to be revised and implemented. Despite Moody’s 2015 downgrade of South African banks (as mentioned), the Basel Committee’s independent evaluation of the implementation of the Basel III regulatory reforms found South Africa’s capital regulation to be compliant with the Basel III requirements as stipulated. Furthermore, South Africa’s adherence to the LCR standard was also found to be in compliance with the Basel requirements, and the banking sector successfully met the requirements by the first target due date which was set for 1 January 2015 (BIS, 2015c:11). Compliance with the NSFR was set for 1 January 2018 and is currently under review by the Basel Committee (BIS, 2013:9; BIS, 2015c:1).

The increased costs banks will have to incur in order to meet the Basel III liquidity requirements will inevitably have a negative impact on profitability (EY, 2015:18), which will in turn disappoint shareholders who are used to higher dividends and better returns on their equity. For banks, it will therefore no longer be "business as usual". Innovative adjustments to current business models and organisational structures will be essential if they are to remain competitive (EY, 2015:34; Reserve Bank, 2015:1). Regardless of any restructuring banks may make to their business models, effective risk management and governance processes remain fundamental to sustained profitability in any business environment.

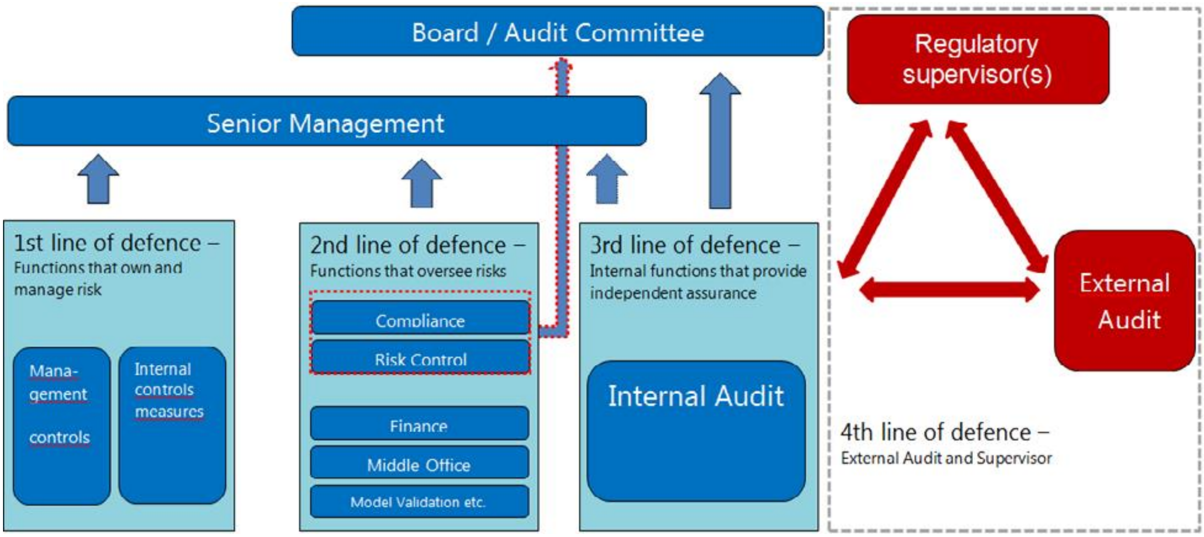
Section 2.5.1 has highlighted the importance of effective risk management and corporate governance within the banking industry. According to the Banks Act, the primary responsibility of an internal audit function is to provide assurance to the board of directors and/or its audit committee that the bank's risk management, control, capital management, and governance processes are in place and effective (South Africa, 2007a, sec.48).

2.6 THE ROLE OF INTERNAL AUDIT IN THE BANKING INDUSTRY

2.6.1 An international perspective

One of the consequences of the international financial crisis has been a heightened interest in internal audit, particularly by banks, as the banking industry now recognises the internal audit function as essential to their efforts to anticipate negative events, and to reduce the likely impact of already identified risks (Abdullatif & Kawuq, 2015:46; IIA, 2015g:4). In the words of Jenitha John, the CAE of Firstrand: *"Due to scrutiny of banks, regulators are increasing their reliance on internal audit and hence many banks are considering creating specific audit teams to concentrate only on regulator requests. This will alleviate capacity constraints faced by audit teams"* (cited in IIA, 2015g:4). The industry's oversight and regulatory bodies have also learned lessons from the financial crisis, and the Basel Committee issued a revised version of their supervisory guidance for assessing the effectiveness of internal audit functions in banks in response to this (BIS, 2012:1). Valuable information regarding the effectiveness of banks' risk management, governance and internal control processes is generated by the internal audit function for the banks' boards of directors and senior management (IIA, 2012a:21; Trudell, 2014:371; BIS, 2015a:32).

The sustainability of banks, as for any other organisation, is dependent on the integration and effective performance of the duties of a number of teams of unique role players. The most prominent of these role players are the board of directors, the audit committee, the risk committee, the senior management team, the compliance and risk management functions, and external audit (IIA, 2013:1). The IIA has therefore introduced the *"Three lines of defence model"* as a means of coordinating the control efforts of all these role players, and thus assisting an organisation in managing its risk, which then increases the likelihood of the organisation achieving its set objectives (refer to section 2.1). In their effort to further enhance the risk management and corporate governance practices, specifically in the banking industry, the Basel Committee has proposed a *"Four lines of defence model"* (an increase on the IIA's *"Three lines of defence model"* (BIS, 2015d:10)). Figure 2.2 illustrates the coordination between these prominent role players within an organisation according to the Basel Committee's model.



(Source: BIS, 2015d:10)

Figure 2.2: Four lines of defence model

The fourth line of defence was specifically introduced to allocate responsibilities to external audit and banking supervisors, as displayed in Figure 2.2. Although these two role players are external to an organisation, they are nevertheless also significant contributors to an organisation's assurance and governance systems (BIS, 2015d:10). Because the internal audit function interacts with all of these role players, it is essential to understand the functions of the other role players in order to better understand the context in which internal audit operates. Table 2.6 summarises the key aspects of the duties of these role players within a bank.

Table 2.6: Role players and their respective roles within a bank

ROLE PLAYER	ROLE WITHIN A BANK
Board of Directors	• Ultimately responsible for managing the bank; provides oversight of senior management to ensure that senior management's efforts to establish and maintain an internal control system are effective (IIA, 2013:3; BIS, 2015a:8). • Supports the internal audit function in the conduct of its duties (IIA, 2012a:19; BIS, 2015a:8).
Audit Committee	• Provides oversight of financial reporting, risk management, internal control, compliance, and ethics, and oversees interactions between management, internal auditors and external auditors (BIS, 2015a:16). • Assists the board of directors with its oversight responsibilities (FSB, 2013:6; IIA, 2015g:9).
Risk Committee	• Provides the board with an overview of the bank's present and future risk

ROLE PLAYER	ROLE WITHIN A BANK
	tolerance or appetite and how these affect the bank's business strategy. (Strategy should address capital and liquidity management, and risks associated with credit environment; the macro-economic and market situation; operations; the compliance environment, and reputation, amongst other risks facing the bank) (FSB, 2013:31; BIS, 2015a:17; IIA, 2015g:9). • Oversees senior management's implementation of the risk management strategy (FSB, 2013:ii).
Senior Management	• Develops and implements internal controls in order to mitigate the risks faced by a bank (BIS, 2012:11; IIA, 2013:3).
Risk Management and Compliance Function	• Serves as a support function to the business units throughout a bank to ensure that the risks facing the respective business units have been identified and effectively managed (BIS, 2012:11; BIS, 2015a:25).
External Auditor	• The external auditor's main objective is to provide assurance to the stakeholders regarding the fair presentation of a company's financial statements (IAASB, 2015 ISA 200 par.3).

ROLE PLAYER	ROLE WITHIN A BANK
	• The external auditor is also required to understand the internal controls relating to the scope of the audit (IAASB, 2015 ISA 315 par.12).

(Source: own deduction)

Table 2.6 makes it clear that each role player's contribution is unique and essential to ensuring the overall effectiveness of a bank's risk management, internal controls and governance processes. The effectiveness of these role players' efforts has to be independently verified, and is usually conducted by a bank's internal audit function. Table 2.7 provides a description of the internal audit function's role and interaction with each of these role players within a bank.

Table 2.7: The internal audit function's role and interaction with other role players in a bank

ROLE PLAYER	INTERNAL AUDIT FUNCTION'S ROLE WITH RESPECT TO EACH ROLE PLAYER
Board of Directors	• Is accountable to the board of directors and provides them with assurance regarding the effectiveness of a bank's risk management, internal control, capital management and governance processes (BIS, 2012:2; IIA, 2012a:19; IIA, 2015g:13).
Audit Committee	• The internal audit function's responsibility towards the board of directors is the same as for the board's audit committee (IIA, 2012a:19; BIS, 2015a:32; IIA, 2015g:13).

ROLE PLAYER	INTERNAL AUDIT FUNCTION'S ROLE WITH RESPECT TO EACH ROLE PLAYER
Risk Committee	• Provides the board of directors with assurance regarding the effectiveness of a bank's risk management function and risk management strategies (BIS, 2012:2; FSB, 2013:24).
Senior Management	• Assesses the effectiveness of the controls that have been implemented by senior management in order to mitigate the identified risks, and issues a report to senior management and the board (or its audit committee) regarding the effectiveness thereof (BIS, 2012:2; IIA, 2013:5).
Risk Management and Compliance Function	• Assesses the effectiveness of the controls that have been implemented and provides assurance to a bank's board and/or its audit committee regarding the effectiveness of these support functions (IIA, 2012a:12; BIS, 2015a:32).
External Auditor	• The internal audit function has no formal reporting responsibility towards the external auditors, but where the external auditors share an interest regarding the effectiveness of a bank's internal controls, it might place reliance on the work of the

ROLE PLAYER	INTERNAL AUDIT FUNCTION'S ROLE WITH RESPECT TO EACH ROLE PLAYER
	internal audit function (IAASB, 2015 ISA 610 par.15).

(Source: own deduction)

The internal audit function is normally required to conduct independent verification of the effectiveness of all the processes of a bank's operations. This would include any outsourced activities, as well as its subsidiaries and branches (BIS, 2012:7; IIA, 2015g:4). According to the Basel Committee, the following bank functions should be independently evaluated by the internal audit function:

- *"Effectiveness and efficiency of internal control, risk management and governance systems in the context of both current and potential future risks;*
- *Reliability, effectiveness and integrity of management information systems and processes (including relevance, accuracy, completeness, availability, confidentiality and comprehensiveness of data);*
- *Monitoring of compliance with laws and regulations, including any requirements from supervisors* (see the following sub-section for more details)*; and*
- *Safeguarding of assets"* (BIS, 2015:32).

That the internal audit function's assurance and opinion is relied on by the Supervisor and by the bank's board of directors, audit committee, senior management, and other stakeholders highlights the importance of the function (South Africa, 2007a, sec.48 (v)(i); IOD, 2009:95-100; IIA, 2015g:8; Reserve Bank, 2015:27; IOD, 2016:70). Internal audit thus plays a vital role in assessing the overall effectiveness of a bank's internal control environment, and by extension, its contribution to maintaining the stability of the global banking industry is equally important.

2.6.2 The role of internal audit in the South African banking industry

The internal audit function is guided by many international organisations' regulations and "requirements", the most significant of these being the IIA's Standards for

Internal Auditors and the Basel Committee's Supervisory Guideline on the Internal Audit Function in Banks (BIS, 2012; IIA, 2012a). Furthermore, both the King III and King IV Reports set out the roles and requirements of internal audit functions in all South African business entities, while the Banks Act (specifically Regulation 48) provides those requirements that are specific to the local banking industry (South Africa, 2007a, sec.48 (k); IOD, 2009:92; IOD, 2016:69). Compliance with the provisions contained in the King III Report (which is currently in force) is mandatory for all companies listed on the Johannesburg Stock Exchange Limited (JSE) (IOD, 2009:6; JSE, 2013a). It should be noted that six of the ten locally controlled banks that form part of this study are also listed on the JSE, and are thus subject to the JSE's listing requirements, the King III requirements and those of the Banks Act (JSE, 2013b).

The Banks Act is industry-specific, mandatory guidance for the South African banking industry. In other words, all locally controlled banks (the focus of this study (refer to section 1.4.4)) have to have an internal audit function. The primary responsibility of an internal audit function in the South African banking industry is to provide assurance to the board of directors or its audit committee regarding the effectiveness of a bank's risk management, controls, capital management, and governance processes (South Africa, 2007a, sec.48). The Banks Act requires the internal audit function in banks to fulfil at least the following roles:

"As a minimum:

- *provide an independent assessment of the adequacy of and compliance with the bank's established policies, processes and procedures;*

Shall examine and evaluate:

- *the adequacy and effectiveness of the bank's internal control systems;*
- *the application and effectiveness of the bank's risk management procedures and risk assessment methodologies;*
- *the bank's management and financial information systems, including the electronic information system and electronic banking services;*

- *the accuracy and reliability of the bank's accounting records and financial reports;*
- *the manner and means in terms of which the bank safeguards its assets;*
- *the bank's system in terms of which the bank assesses its capital and reserve funds in relation to the bank's risk exposure;*
- *the systems and processes established by the bank in order to ensure compliance with any relevant legal and regulatory requirements, codes of conduct and the implementation of policies and procedures;*
- *the manner in which assigned responsibilities are fulfilled;*
- *the bank's compliance with policies and risks and controls;*
- *the reliability, integrity, accuracy, completeness and timeliness of financial and management information;*
- *the continuity and reliability of the electronic information systems;*
- *the functioning of the staff departments;*

Shall conduct:

- *an appraisal of the economy and efficiency of the bank's operations;*
- *appropriate testing of:*
    - *Transactions*
    - *The functioning of specific internal control procedures;*
    - *The reliability and timeliness of the bank's regulatory reporting;*
- *relevant special investigations from time to time;*

Shall evaluate whether or not senior management of the bank:

- *developed and maintained sufficiently robust risk management processes and procedures to identify, measure, monitor and control the risks to which the bank is exposed;*
- *at least once a year reports to the board of directors the scope and performance of the bank's internal controls system and the bank's capital assessment procedure;*
- *maintains an organisational structure that clearly assigns responsibility, authority and reporting relationships, and ensures that delegated responsibilities are effectively carried out;*

- *developed and maintains appropriate internal control policies;*
- *continuously monitors the adequacy and effectiveness of the internal control system;*

Shall regularly:

- *report to and advise senior management and the board of directors or audit committee, as the case may be:*
  - *on the performance of the internal control system;*
  - *on the achievement of the objectives of the internal audit department;*
- *inform senior management and/or the board of directors or audit committee about the progress made in respect of the audit plan"* (South Africa, 2007a, sec.48 (l & v)).

The scope of the internal audit function within the South African banking industry is thus broad and comprehensive, addressing all of a bank's activities and departments. The Banks Act's description of the role of internal audit is congruent with that contained in the IIA's definition of internal audit (refer to section 1.1). The internal audit function is primarily intended to assist management with the achievement of their objectives through an independent evaluation of the effectiveness of risk management, internal controls and governance processes. In addition, the King III and King IV Reports require an internal audit function to use a risk-based approach when conducting its independent evaluations (IOD, 2009:94; IOD, 2016:70), as does the Basel Committee's requirements (BIS, 2012:4) and the IIA's Standards for internal audit (IIA, 2012a:9, Standard 2010).

The internal audit function has been present in business for many years, and seems set to continue, in light of the demands of the widest range of stakeholders in response to recent corporate failures and the global financial crisis (IIA, 2015g:11). The country's banking industry requires a strong internal control environment and effective corporate governance (which is assessed by the internal audit function) as its minimum standard to maintain the stability and viability of the industry. Without the assurance provided by the internal audit function, the country's banking industry would be vulnerable to risks and possible bank failures. This heavy responsibility can only be successfully achieved if the internal audit function's assessment tools and techniques are appropriate and effective. Thus, the effectiveness of the performance of tests of controls rests on the choice of appropriate tools and techniques (such as the use of GAS), so that any weaknesses in the bank's risk management, internal controls and governance processes can be identified efficiently and effectively.

2.7 A BRIEF OVERVIEW ON THE USE OF CAATS AND GAS BY INTERNAL AUDITORS

Section 1.1 made reference to the advances in technology now being deployed in organisations and the increase in the volume of audit evidence that is predominantly only available in electronic format. Banks process thousands of transactions each and every day, and the impact and outcomes of some transactions extend over long periods of time. To reiterate (as mentioned in section 1.1), banking practices are no longer restricted to one country, time zone or jurisdiction, but are characterised by cross-border transactions in multiple countries under a plethora of different legal and regulatory frameworks. In addition, section 2.6 also emphasised the different role players that the internal audit function interacts with during the execution of its duties. It is thus clear that the internal audit function has to serve multiple stakeholders which at times have different and diverging expectations of the internal audit function, resulting in additional pressure being put on the function (IIA, 2015g:11). In addition, rising expectations on the part of these various stakeholders have also increased internal audit workloads, which puts internal audit's resources under further pressure (Trudell, 2014:371; Abdullatif & Kawuq, 2015:46; Chambers, 2015:46; IIA, 2015g:11). The internal audit function therefore has to be innovative, utilising appropriate tools and techniques (such as CAATs and GAS) in order to collect sufficient, reliable and useful evidence in performing tests of controls. The use of these technology-enabled tools and techniques should enable the internal audit function to deliver on its mandate in an effective and efficient manner, alleviating the pressure on its limited resources. The next chapter thus provides a detailed discussion of the use of CAATs and GAS by internal auditors when performing tests of controls reviews.

2.8 CONCLUSION

In this chapter a discussion of internal auditing as an independent assurance provider and its evolving role in the banking industry was undertaken. The increased use of technology and computerised systems in organisations has resulted in the generation and storage of very large databases (Hussein, 2013:ii). This technological era of big data brings many challenges to organisations with regard to the storage, managing, protection and use of data (IIA, 2015g:16; ISACA & Protiviti, 2015:3). This era of big data also has already had a direct impact on the internal audit function's efforts when gathering audit evidence for tests of controls purposes from extremely large audit populations, and this is especially pronounced in the banking industry. As a result, the internal audit function has had to adapt to the latest developments so as to ensure it remains relevant in delivering on its mandate. Section 2.2.6 highlighted the key points in which the role of the internal audit function has been revolutionised, and specific emphasis was made to the increased use of technology-enabled tools and techniques by internal audit functions in order to ensure it can deliver on its mandate in an effective and efficient manner.

The internal audit function is a key role player, providing assistance to senior management and the board with their efforts to achieve their respective objectives. The ever-changing organisational landscape, as well as the changing nature of risk, necessitates that the internal audit function continuously revisits their approach and scope of work in order to stay abreast of current and emerging risks facing the banking industry. With the "macro-economic environment" (the risk that economic conditions could damage banks) having been identified as the top concern for both the global and local banking industry (as mentioned in sections 2.5.1 and 2.5.2) it is clear that banks are still concerned about the global economic recovery. As the global banking industry remains under intense scrutiny by regulators, and subject to pressure to comply with the escalating number of new guidelines and standards published by international standard-setting bodies and regulators, and amended national legislation, it is clear that the internal audit function's role will remain vital in contributing to a well-managed and sustainable banking industry.

The next chapter provides an overview of the use of technology in the banking industry and the impact of that on audit evidence. This is followed by a discussion of the use of CAATs and GAS employed by internal auditors as they pertain to tests of controls. The advantages and disadvantages, amongst others, of GAS are discussed, as are the criteria for the adoption and/or rejection of the use of GAS by internal audit functions. The use of continuous auditing is also explained in broad overview. The chapter concludes with an overview of the different data analytics maturity frameworks.

CHAPTER 3
TECHNOLOGY-BASED TOOLS AND THE INTERNAL AUDIT FUNCTION

3.1 INTRODUCTION

The advances in information technology over the recent decades have enabled organisations to place an increased reliance on computers to process business transactions (Chang, Yen, Chang & Jan, 2014:187; Elefterie & Badea, 2016:303). As a result, information technology is no longer limited to a single business unit inside an organisation (as was previously the case) but is now seen as a business enabler that integrates and is integrated in all functions and business units across an organisation (Roos, 2012:25). Information technology supports organisations' supply chain management; it enables direct communication with customers and also enhances the marketing and selling of products. In comparison, the "traditional" manner of conducting business was predominantly reliant on manually operated systems and processes. The impact of computers and technology on the business industry is probably best described in the words of Joe Mysak (and still hold true today):

> "*For most of the twentieth century, the (municipal bond) market operated in an almost serenely simple style. Market historians will disagree as to when, exactly, the market changed…we really have to go back to August and September 1961. That period marked the first recorded use of a computer to tabulate bids on bond issues…by a maverick named William S. Morris…Put together from a Heath kit, the [computer] made all else possible. The thought of putting together, say, a combine multipurpose crossover and net cash refunding with synthetic fixed-rate maturities, or a deal mixing variable rate, fixed, and zero-coupon bonds – well, we leave it to your imagination.* ***Such deals would have been unthinkable in the pre-computer age****"* [own emphasis] (cited in Ehlrich, 1998:197).

The development of technology also had a significant impact on the banking industry (section 3.3 provides a brief overview of the use of information technology in the banking industry). One of the main impacts of technological innovation, was the ease of processing and transmission of information that it introduced. Accordingly, banks can now effortlessly market their products and services on a globally networked platform. In addition, the development of information technology has also resulted in the transformation of banks' product ranges, its service channels and the types and packaging of its services (Campanella, Peruta & Giudice, 2015). In other words, embracing information technology has enabled banks to be more efficient in their service delivery to their customers and other stakeholders. Banks rely heavily on information technology for support for their management control systems, and to enable them to provide the government regulator (such as the Reserve Bank's Supervision Department) with the information required to demonstrate their compliance with legislative requirements (Eastburn & Boland, 2015:160). Today, banking practices are no longer restricted to one country or jurisdiction (as mentioned in section 1.1), but are characterised by multidimensional sets of transactions impacting multiple countries, while trying to honour a plethora of different legal and regulatory frameworks. For this reason, banks are reliant on a global network of data processing and information systems to provide their core banking services, and to enable them to effectively manage the macroeconomic elements of their industry (Eastburn & Boland, 2015:160).

This dependency on data by organisations and specifically banks in order to run their core business functions has resulted in the generation and storage of big data. Big data (also refer to section 1.1) has become a critical resource for almost all present-day organisations: it is critical because of the wholehearted reliance being placed on it as it enables informed business decision making and the development of coherent business strategies (Griffin & Wright, 2015:377; Deloitte, 2016b). Important information about the effectiveness of an organisation's internal controls and risk management practices, its behavioural ethics, regulatory compliance, reliability of its financial statements and its performance is concealed in its data (Zitting, 2016:2). On the other hand, organisations are increasingly faced with challenges around the storage, managing, protection and utilisation of this big data (IIA, 2015g:16). This holds equally true for the banking industry, in which **technology risk** has recently been identified as one of the top 10 risks (refer to section 2.5.1) faced by the global banking industry, according to the global banking risk survey conducted by CSFI (CSFI, 2015a:16).

Technology risk (the risk that banks might fail to stay up to date with technological change) has been further accentuated with the arrival of the digital and mobile banking revolution (CSFI, 2015a:16). In order for banks to ensure they stay abreast of all the technological advancements and the escalating usage of the ever-increasing resource known as “big data”, they have to ensure that their systems and infrastructures are up to date, so as to be effective in providing their core banking services. Failure to do so could result in banks having to face the strategic dilemma called agility risk, which could leave banks vulnerable to all the risks posed by aging technology (Westerman & Hunter, 2007:4). Agility refers to the adaptability and/or flexibility of an organisation’s legacy information systems, a measure of the ease with which they can be updated or enhanced to accommodate new technologies, within reasonable cost and speed parameters (Westerman & Hunter, 2007:23). In a survey conducted by the Supervisor to determine the adequacy of South African banks’ policies protecting them from information technology risks, it was pointed out that the South African banking industry is currently vulnerable to the risks associated with their relative lack of agility (Reserve Bank, 2015:7). Because of the strategic importance of maintaining effective technology inside an organisation (as highlighted earlier), issues surrounding technology have to receive the necessary attention at an executive level. The King III Report (IOD, 2009:85) and COSO (2013:72) recognise this, requiring the board of directors and management to incorporate information technology risks into the company’s risk management processes (refer to section 2.2.4). In addition, the King IV Report also emphasises the board of directors’ responsibility with regard to the governance of risk associated with technology and information (IOD, 2016:62). The board of directors, as one of the key role players in the effective governance of a bank (refer to section 2.6.1), is ultimately responsible for managing the bank; it also provides oversight of senior management so as to ensure that senior management’s efforts to establish and maintain an internal control system are effective (IIA, 2013:3; BIS, 2015a:8). This is accomplished through its reliance on the work conducted by the internal audit function. The internal audit function is accountable to the board of directors and provides them with assurance regarding the effectiveness of a bank's risk management, internal control, capital management and governance processes (BIS, 2012:2; IIA, 2015g:13).

With increasing reliance being placed on technology by organisations, and the ever increasing size and complexity of the resource known as "big data" (as previously mentioned), the internal audit activity will have to be innovative in its efforts to obtain persuasive audit evidence to support the achievement of their various engagement objectives (section 3.2 provides a discussion on audit evidence). The IIA's Research Foundation (2016o:6), in their 2016 (CBOK) report on *Data Analytics: Elevating Internal Audit's Value*, also draws attention to the transformation of the traditional (manual oriented) internal audit function to one that now needs to adopt the use of technology-enabled tools and techniques in order to deliver on its mandate. In other words, the modern internal auditor will have to utilise tools and techniques that will enable him or her to take advantage of the wealth of data and information that resides in an organisation's systems (refer to section 2.2.6 regarding the revolution (re-engineering) of the role of the internal audit function). The traditional methods of collecting audit evidence (as was highlighted in section 2.2.6) are limited and do not fit the professional profile of the modern day internal auditor. Zitting (2016:2) points out that the traditional internal audit methodology of collecting audit evidence through the conduct of interviews, the completion of questionnaires, and by testing controls on a sample basis, is long overdue, and emphasises that such practice in the present technological, data-driven era will soon render such an internal audit function obsolete. This view is also shared by the IIA (IIA, 2016o:1). It is thus of utmost importance that modern day internal auditors utilise appropriate tools and techniques in order to embrace the power of data in such a way that will lead to meaningful analyses of the data (electronic audit evidence) collected. In addition, PwC (2016:11) in its *2016 State of the Internal Audit Profession Study* also points out that effective internal audit functions invest in data analytics and technology-enabled tools in order to embrace the revolution currently changing the organisational landscape.

The most prominent use of technology-enabled tools and techniques, namely the use of CAATs and specifically GAS, is the focus of this study (refer to section 1.2). A detailed discussion on these techniques is provided in sections 3.4 and 3.5 respectively. It should be borne in mind that there are different levels of maturity displayed by internal audit functions in their adopting and utilising data analytics concepts and techniques. Therefore, sections 3.6 and 3.7 are devoted to providing an overview of the use of continuous auditing (i.e., the more advanced use of analytics) as well as the different data analytics maturity frameworks. The next section provides an overview of the impact of information technology and big data on the collection of audit evidence.

3.2 THE IMPACT OF INFORMATION TECHNOLOGY AND BIG DATA ON THE COLLECTION OF AUDIT EVIDENCE

The premise underlying why auditors collect audit evidence is probably best described in the words of Bruce Marshall: *"Auditors are like St Thomas; they require to see before they believe"* (cited in James & Parker, 1990:10). In other words, what can be derived from this statement is that auditors have to obtain tangible information or evidence that substantiates the conclusions they reach. Section 1.1 made reference to the IIA's definition of internal audit and emphasised that its mandate is to help an organisation accomplish its objectives by bringing a systematic, disciplined approach in order to evaluate and improve the effectiveness of governance, risk management and control processes implemented by organisations' management teams. Following from this definition it should be clear that the execution of an internal audit engagement is centred around assisting the auditee, through its independent evaluation by expressing an opinion on the achievement of the auditee's set organisational objectives.

Even though objectives are established by organisations' respective management teams, it should be noted that, by merely conducting its daily business activities and transactions these objectives are susceptible to failure, should an underlying risk event occur (COSO, 2013:18). Risk can be defined as the occurrence of an unforeseen event which may adversely impact the achievement of organisational objectives (IIA, 2012a:22; COSO, 2013:59). It is for this reason that management implements mitigating actions or controls in order to manage or prevent these unforeseen risk events from adversely impacting the achievement of their set objectives. In other words, effective controls should increase the likelihood of an organisation's objectives of being accomplished (this is independently validated by the internal audit function in accordance with its purpose and mandate as mentioned in section 2.2.2). Contrary-wise, the identification and assessment of risks may also lead to the identification of opportunities (i.e., the possibility that an event will occur and *positively* impact the achievement of objectives) which the management team of an organisation should take advantage of (COSO, 2013:59; IOD, 2016:61).

In the same way as organisations have set objectives that they intend to achieve, the internal audit function also has specific objectives to achieve for every engagement conducted. Standard 2210, *Engagement Objectives,* therefore requires the internal audit function to develop objectives for each engagement performed (IIA, 2012a:13). The engagement objectives can be seen as the "roadmap" for the upcoming engagement as the rest of the internal audit engagement process is centred on the engagement objectives. Section 2.2.3 provided a discussion on the systematic disciplined approach of conducting an internal audit engagement. In addition, Standard 2220, *Engagement Scope,* reiterates that the engagement scope should include all relevant aspects in order to address the established engagement objectives (IIA, 2012a:14). One of the systematic phases of conducting an internal audit engagement (as mentioned in section 2.2.3) is the engagement work program. It is during the engagement work program phase that the internal auditors have to develop insightful audit procedures in support of the set engagement objectives (IIA, 2012a:14). The audit procedures are designed to provide guidance and instructions to the internal auditors in collecting persuasive evidence that is sufficient, reliable, relevant, and useful to support the achievement of engagement objectives (IIA, 2012a:14, Standard 2310; IAASB, 2015 ISA 500 par.6). Standard 2310, *Identifying Information,* defines sufficient, reliable, relevant, and useful information as follows: "***Sufficient information*** *is factual, adequate, and convincing so that a prudent, informed person would reach the same conclusions as the auditor.* ***Reliable information*** *is the best attainable information through the use of appropriate engagement techniques.* ***Relevant information*** *supports engagement observations and recommendations and is consistent with the objectives for the engagement.* ***Useful information*** *helps the organization meet its goals"* (IIA, 2012a:15).

Calota and Vinatoru (2015:14) point out that the quality of audit evidence obtained is directly related with the audit procedures employed in obtaining it. In other words, the

reliability of information is dependent on the appropriate tools and techniques (i.e., audit procedures) being applied in obtaining the audit evidence. Ratliff and Johnson (1998:56) highlight the importance of the relationship between evidence and the audit conclusions: the better the quality and reliability of the evidence the more reliable the audit conclusion should be, and vice versa. In addition, Smidt (2014:82) also draws attention to the importance of the relationship between the test objective and the related audit procedure. In other words, incorrect or inappropriate audit procedures might adversely impact the achievement of test objectives and ultimately compromise the achievement of the respective engagement objectives (IIA, 2015h, Practice Advisory 2120-2). Florea and Florea (2011:358) support this view.

Various audit procedures are available to the internal auditor to collect sufficient, reliable, relevant, and useful audit evidence in order to address the respective engagement objectives. The purpose of this research, focused as it is on internal audit (refer to section 1.2) and the audit procedures discussed here, is therefore conducted within the context of conducting tests of controls. Each of these audit procedures (as identified by various authors of auditing literature (Josiah & Izedonmi, 2013:3; ISACA, 2014:110; Calota & Vinatoru, 2015:14; IIA, 2015h, Practice Advisory 2320-1; IAASB, 2015 ISA 500 par.A14-A25; Suedbeck, 2016:13)) are briefly discussed below.

3.2.1 Inspection

Documented evidence such as records indicating compliance with an internal control procedure (whether such a document or record was generated internally or externally or in paper format or electronic format), is usually verified through inspection by the internal auditor. For example, the verification of a signature on a purchase invoice by the procurement manager will provide evidence of the authorisation of that specific transaction. Audit evidence obtained through inspection usually has a higher degree of credibility than evidence that was obtained through verbal evidence obtained through inquiry and interview. The high degree of credibility can possibly be linked to the internal auditor’s objective evaluation (through the inspection), of compliance with a specific control that was implemented by management.

3.2.2 Observation

The internal auditor may also decide to physically observe a specific procedure, such as the inventory counting by the organisation's personnel, in order to assess whether the internal controls are being adhered to as described in the organisation's policies and procedures. The credibility of audit evidence obtained through observation may be limited due to the fact that the execution of the observed act and its adherence to internal controls may perhaps occur only when the responsible (and observed) personnel know that the internal auditor is observing the process or procedure. Audit evidence obtained through observation might therefore only be relevant for the specific time that the observation occurred.

3.2.3 External confirmation

Audit evidence obtained through external (third-party) confirmation usually has a higher degree of credibility than does evidence that has been generated internally by and within the organisation. For example, the internal auditor may want to conduct an audit of the contract management process inside an organisation, and would like to confirm the accuracy of the terms and conditions stipulated in such a contract. The internal auditor can verify the accuracy of this through a written confirmation from the external third party stating the terms and conditions of the contract in question. The high degree of credibility associated with external confirmation may rest in the fact that the external confirmation is unbiased: in other words, such evidence should be original (not a repetition of an in-house document), factual and correct.

3.2.4 Recalculation

The internal auditor may also decide to perform a recalculation in order to verify the mathematical accuracy of a document or record. For example, the internal auditor may want to verify the accuracy of a specific system application in calculating tax credits. This can be conducted manually or electronically with the use of GAS (refer to section 3.5.1 for a discussion on the use of GAS). The objective recalculation by the internal auditor also confers a high degree of credibility on the evidence obtained to validate the mathematical accuracy of documents or records.

3.2.5 Re-performance

When the internal auditor wants to verify the adequacy and effectiveness of implemented controls embedded in the auditee's internal processes he/she can also verify this by independently performing the specific control or procedure. The internal auditor will then compare his independent test results to those which were originally processed by the auditee in order to conclude on the adequacy and effectiveness of the respective internal control. This re-performance by the internal auditor can either be conducted manually or electronically, again with the use of GAS (refer to section 3.5.1 for a discussion on the use of GAS). The audit evidence obtained through re-performance also has a high degree of credibility, due to the fact that the internal auditor directly verifies the existence and effectiveness of the respective internal control.

3.2.6 Analytical procedures

Internal auditors may also use analytical audit procedures to identify anomalies for further investigation, as part of gathering evidence regarding the adequacy and effectiveness of implemented controls. Analytical procedures involve a comparison of relationships between both financial and non-financial information. Examples may include:

- a comparison of current period information with prior period information;
- an analysis of the relationship between the recorded monthly payroll expense against the number of employees on the payroll; and
- a comparison of actual information against expectations based on similar information for other organisational units, as well as for the industry within which the organisation operates.

Analytical audit procedures can provide the auditor with very useful information, such as unexpected differences, potential errors, potential fraud or illegal acts, and any other unusual or nonrecurring transactions that warrant further emphasis. These procedures can also be conducted with the use of GAS (refer to section 3.5.1 for a discussion on the use of GAS).

3.2.7 Inquiry

Audit evidence can also be obtained through the use of inquiry. Throughout the conduct of an internal audit engagement the internal auditor will use inquiry extensively in order to obtain information so as to perform the audit in an effective and efficient manner. Inquiry may take the form of written requests from the auditor to, or informal discussions or interviews with the respective control owners in the organisation. Evidence obtained through inquiry is useful as it supports or enriches other forms of audit evidence obtained, and may provide insights that were not previously known. On the other hand, audit evidence obtained solely through inquiry is not regarded as credible audit evidence and should always be corroborated as far as possible with other forms of audit evidence.

The selection of the appropriate audit procedure, as discussed earlier, is dependent on the auditor's engagement objective, and especially the internal auditor's specific test objective. The test objective recorded in the engagement work program provides clarity as to "why" the internal auditor wants to conduct a specific audit procedure. Thus, regardless of the type of internal audit engagement (whether it be a fraud risk evaluation, operational audit, compliance audit, environmental audit, financial control audit and/or an information technology audit), it is performed to achieve a specific set of engagement objectives. These objectives are usually related to the gathering of audit evidence through the application of a specific audit procedure in order to prove or disprove a set of criteria that may or may not exist in the underlying control environment (Suedbeck, 2016:13).

Apart from the various types of audit procedures that are available to collect audit evidence, the internal auditor also needs to ascertain whether the audit evidence to be obtained is available in electronic format and/or paper format. In this current technology- and data-driven era (refer to section 1.1 and 3.1), audit evidence is now almost exclusively available in electronic format (Ahmi & Kent, 2013:89; COSO, 2013:25; PwC, 2014:25; IIA, 2015g:14). Paperless environments are the norm, and internal audit functions have to adapt in order to deliver on their mandates. In addition, from an internal auditing perspective control environments are subject to electronic evidence. Electronic audit evidence can be classified as information created, transmitted, processed, recorded and/or maintained electronically, that supports the content of an audit report (Josiah & Izedonmi, 2013:2). Table 3.1 provides a comparison between the traditional (paper-based) audit evidence and electronic audit evidence. This comparison was compiled from the work of various authors of auditing literature (Williamson, 1997:69; Shaikh, 2005:409; Caster & Verardo, 2007:69; Coderre, 2009:4; Josiah & Izedonmi, 2013:2; Brown-Liburd & Vasarhelyi, 2015:6; Zuca, 2015:703; IIA, 2016o:6; Singh & Best, 2016:35). The table also highlights the unique differences between these two broad categories of audit evidence, as well as indicating the impact that information technology has had on traditional forms of audit evidence (refer to the electronic audit evidence column).

Table 3.1: A comparison between paper and electronic audit evidence

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
Source	Exists mainly in paper form. The source of the audit evidence can easily be established through inspection of the paper or hardcopy documentation.	Exists mainly in electronic form. The source of the audit evidence is more difficult to establish and will require specific security techniques and non-repudiation in order to establish the source of the evidence that was generated by the information system. In other words this refers to the “variety” component of big data and deals with data or information that is retrieved from multiple sources, for example, blogs, video streams, website traffic and audio files. It may also be

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
		stored in separate databases, computer files and/or servers.
Alteration	Modification of paper or hardcopy evidence should be detected as it may leave an audit trail of the modification that was made.	Modification of the information that was processed will be difficult to detect through solely examining the electronically generated information. In cases for example where segregation of duty violations exist in the system or application, the user processing a specific transaction may easily erase the audit trail that was recorded by the system. Therefore, the reliability of electronic information is dependent on strong security controls that will ensure the integrity of the information processed by the system.
Approval and signature	The approval of a paper based document is tangible and indicates a handwritten signature by the authorised	The approval of a document or transaction through electronic means usually occurs through the existence

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
	person. A specimen signature can usually be traced to a specific person.	of a workflow that is set-up in the system, in line with a specific user's line of job responsibilities and access privileges. In the case of ineffective system controls it will be difficult to trace a specific electronic/or digital signature to a specific person or user as certain users may have more access and modification privileges linked to their job profile or function than they are supposed to have.
Completeness	There is usually a tangible paper audit trail that can be followed from the source documents through to the journal entries and finally to the financial statements. The incompleteness of a transaction should be easily identifiable.	Electronic data are sometimes transmitted between different applications through system interfaces and not all data or information may be completely transferred, or it may be lost or intercepted during transmission. Duplicate transactions may also be processed. Strong system controls will have to be in place in order to ensure the completeness of

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
		data and information. The traditional “paper audit trail” now consist of a “paperless” audit trail via system logs which are only available in electronic format.
Reading	The information is contained in hardcopy or paper based format and therefore can easily be read by the internal auditor without the use of any specialised skills, tools or techniques.	At times it may be difficult to “read” the data or information in the system as it might be unstructured and not in a user friendly format. It will thus be difficult for the internal auditor to analyse such data in a meaningful way. Specialised tools and techniques may be required to read the data.
Format	Each paper based document, such as an invoice, has a specific format and this forms an integral part of the document.	The format of data and information in the system can easily be changed and may not be consistent throughout the organisation: this could have an adverse impact on the internal auditor’s evaluation thereof.
Availability and accessibility	Paper based documents should usually be available during the period of the	The audit trail for electronic data may not be readily available at the time of the

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
	audit and can easily be retrieved from a cabinet or hardcopy file.	audit and accessing the data from the system may prove to be difficult.
Clarity	Paper based evidence is usually clear: it is easy to make an evaluation from this type of evidence.	Electronic audit evidence may not always be clear: data is vulnerable and may easily be altered, which could compromise the confidentiality, integrity and availability of the data.
Ease of use	Paper based evidence does not require knowledge of specialised tools and techniques in order to evaluate and understand the evidence obtained.	Electronic audit evidence may require data extraction tools and techniques to evaluate and understand the evidence.
Credibility	Paper based evidence tends to have a high degree of reliability.	The reliability of electronic audit evidence can easily be compromised and is dependent on a strong internal control structure that resides within the information technology environment. Thus the “veracity” component of big data deals with the relevance and truthfulness

CHARACTERISTICS OF EVIDENCE	PAPER AUDIT EVIDENCE (TRADITIONAL ENVIRONMENT)	ELECTRONIC AUDIT EVIDENCE (PAPERLESS ENVIRONMENT)
		of the data.
Volume	The volume of paper based evidence is reasonably manageable, remains static and exists in hardcopy form.	Substantial volumes of data or information that reside in organisations' control environments and systems are continuously and rapidly increasing. Data volumes today can already be measured in zettabytes (i.e. 1 trillion mega-bytes).
Velocity	Information is only available after the transaction has been processed.	Data or information is available in real-time.

(Source: own deduction)

Reviewing the information in Table 3.1, it should be clear that the traditional means of collecting audit evidence for tests of controls purposes (as mentioned in section 2.2.6) will, in a paperless environment now be inappropriate and impractical to apply, especially in the present-day business environment which is dominated by "big data" (also refer to sections 1.1 and 3.1). It should be noted however, that the overall objectives of the internal audit function (to provide independent assurance over the adequacy and effectiveness of a company's risk management, control and governance processes) to a large extent remains unchanged (Madani, 2009:514; IIA, 2016o:8). This is also noticeable in that the internal audit function's statement of responsibilities has only been revised eight times over the past 75 years of the profession's existence (refer to section 2.2.1). The fundamental change that has occurred lies in the manner of "how" these overall objectives are achieved (as depicted in the function's statement of responsibilities (also refer to section 2.2.6)).

The rapid evolvement of data (electronic evidence) and the development of software tools and techniques to enable analysis of that data has had a significant impact on "how" the internal audit function goes about obtaining audit evidence in order to still deliver in terms of its statement of responsibilities (IIA, 2016o:8). Tsai, Chen, Chang, Leu, Chen and Purbokusumo (2015:728) also recognise the significant impact of information technology on the audit profession and the manner in which internal auditors evaluate risks and controls through audit automation. Haislip, Peters and Richardson (2016:2) argue that auditor competency in the area of information technology correlates with the ability to identify internal control breakdowns related to information technology.

As mentioned earlier, audit evidence (whether paper based or electronic) is primarily obtained from the conduct of audit procedures throughout an internal audit engagement. The IAASB (2015 ISA 500 par.A26) points out that the quality of **all** audit evidence gathered during the conduct of an audit is dependent on the **reliability** and **relevance** of its underlying sources. Brown-Liburd and Vasarhelyi (2015:1) draw attention to the fact that the audit profession and regulators should be mindful of the impact that the present day technological environment has on traditional forms of audit evidence. In other words, audit procedures or approaches to collecting audit evidence that once used to produce "sufficient, reliable, relevant, and useful" audit evidence in a paper based environment may no longer be effective in today's technology-driven era. In addition, Yoon, Hoogduin and Zhang (2015:432) also observe that the scope and quality of the audit evidence obtained are impacted by technology, cost/benefit considerations and the interaction with the auditee. In an effort to increase the reliability of electronic information obtained as audit evidence, Josiah and Izedonmi (2013:4) offer the following guidelines to evaluating the reliability of electronic information prior to basing audit conclusions on such information:

- Authentication: The credentials of the individual user or entity should be verifiable.
- Integrity: The assurance that the information that was created, processed, transmitted, maintained and/or obtained was validated in order to ensure that the information was complete, accurate and had not been modified.

- Authorisation: Verify that the information that was prepared, processed, modified, corrected, sent and accessed was handled by individuals/users whose job functions and responsibilities were aligned with their positions in the organisational hierarchy, and in accordance with their system access privileges.
- Non-repudiation: The sender and/or recipient of information cannot dispute the fact that the exchange of the information/content took place. There should thus be evidence of non-repudiation of origin, non-repudiation of receipt and/or non-repudiation of the content.

Therefore, one of the most fundamental mistakes that the internal auditor can potentially make is to reach audit conclusions which are based on unreliable audit evidence. Section 2.2.3 provided a discussion of the systematic phases in conducting an internal audit engagement, and indicated that the final deliverable of an engagement is the internal auditor's report. Standard 2410, *Criteria for Communicating,* requires the internal audit function to incorporate the engagement objectives, scope, recommendations and action plans in its audit report. It further requires that the internal audit function's opinion or conclusion also addresses the expectations of senior management, the board, and other stakeholders, and emphasises that such an opinion be supported by sufficient, reliable, relevant, and useful information (IIA, 2012a:15). The importance of the content included in the audit report (and especially the risks and opportunities that are highlighted) is derived from the audit evidence that was gathered during the conduct of audit procedures. The importance of reliable audit evidence therefore cannot be overemphasised, especially with the reliance that is placed on the internal auditor's report, as previously mentioned. As COSO (2013:18) points out, the statement by an internal audit function regarding the effectiveness of an organisation's control environment means that management can be reasonably confident regarding the likely achievement of its objectives, and vice versa.

The organisational era of technology and big data is here to stay. It is therefore unavoidable for all internal audit functions to embrace the power of technology and to incorporate it into their audit methodologies (also refer to section 2.2.5). Sections 3.4 – 3.6 provide a discussion on the use of CAATs, GAS and continuous auditing techniques that can be employed by internal audit functions in the collection of audit evidence. On the other hand, internal audit functions that might still resist the change that the era of big data and technology is effecting will run the risk of soon becoming obsolete. PwC (2016:7), in their *2016 State of the Internal Audit Profession Study* remarked: *"A business-aligned strategic plan enables internal audit to define and act upon the function's vision in a way that is (1) rooted in a deep understanding of the organisation's strategic objectives and risks and (2) enabled by talent, processes, and* ***technology*** *[own emphasis] needed to keep pace with the strategic direction of the organisation."* The adoption of technology is already critical for any organisation in order to run their core business functions; this is also true for the banking industry. The next section therefore provides a brief overview of the availability and utilisation of technology within the banking industry.

3.3 A BRIEF OVERVIEW OF THE USE OF TECHNOLOGY IN THE BANKING INDUSTRY

Competition between different organisations and between industries is a global occurrence, and the banking industry is "just another industry" in this context. In the words of Donald Kendall: *"Hardnosed competition is the best assurance of a healthy business. It has done more to modernise our plants, more to train our people and improve our systems and broaden our product line than any other force on earth including pride, ambition and naked greed"* (cited in James & Parker, 1990:32). One of the most prominent interventions by the global banking industry in response to the pressures arising from increased competition, legislation, stakeholder demands, regional economic downturns and changing customer expectations continues to be to invest in information technology (Campanella *et al*., 2015; EY, 2015:23; IIA, 2015g:4; Shaikh & Karjaluoto, 2015:130). Section 3.1 also made reference to the transformation of banks' core banking services, which has been made possible as a result of the adoption of technology. Binuyo and Aregbeshola (2014:59) draw attention to the important role that commercial banks play in the financial stability of a country's economy and emphasise the importance of the efficient and effective running of a bank's operations in order to remain competitive and to offer sustainable financial services to its customers. They also point out the reduction in overhead costs achieved by the banking industry as a result of the adoption of information technology, which allows for a more cost efficient approach to delivering its core banking services. Some of the common technology-based uses adopted by the present day banking industry are Enterprise Resource Planning systems (ERP), automated teller machines (ATMs), electronic card payments, internet banking and mobile banking (Campanella *et al*., 2015; Peres, 2015:218; Takieddine & Sun, 2015:361; South African Banking Risk Information Centre (SABRIC), 2016a). Each of these technologies is now briefly discussed.

3.3.1 ERP systems

Banks' operations are characterised by the need to process extremely large volumes of data (also refer to section 3.1) as a result of the accelerating adoption of electronic-type banking transactions that must be processed through their banking systems daily, if not in real time (Eastburn & Boland, 2015:161). Consequently, banks have had to reinvent their business models and the manner in which they conduct banking in today's digital banking era. In an effort to reduce their operating costs, and to increase their efficiency and productivity, and to improve their service speeds to the banking community, they have invested in ERP systems (Campanella *et al*., 2015; Eastburn & Boland, 2015:161; EY, 2015:23). ERP systems are end-to-end business solutions that provide organisations with an integrated, real-time view of all their business processes. These processes include: Financial Accounting, Management Accounting, Logistics, Material Planning, Manufacturing, Lifecycle Data Management, Enterprise Asset Management, Customer Relations Management, Supplier Relations Management, Programme and Project Management and Human Capital Management (Madani, 2009:516; Ansen, 2014:149; Tsai *et al*., 2015:727). In other words, organisations that run their businesses on ERP systems no longer have to transfer and reconcile data from various databases (hosted on legacy systems) spread across an organisation: ERP systems allow for a unified and/or integrated view into one virtual system (Madani, 2009:517; Alhirz & Sajeev, 2015:164). In addition, ERP systems are also capable of processing thousands of transactions (data) on a daily basis, hence the popularity of investing in such systems by organisations including banks (Singh & Best, 2016:35). Furthermore, Tsai *et al.,* (2015:728) remark that the implementation of ERP systems, through its functionality of gathering unified information about an organisation's transactions, can also contribute towards an increase in the implementation of auditing software such as CAATs by internal audit functions. The use and implementation of auditing software such as CAATs and GAS is discussed in sections 3.4 and 3.5 respectively.

3.3.2 ATMs

In today's fast paced world customers are increasingly demanding that business is conducted in a more efficient manner and at a time and place that is suitable for them. The implementation and evolvement of ATMs has enabled customers to do just that. The first two ATMs in South Africa were introduced in 1977, and as a result has made banking more convenient and accessible to the banks' various customers, to the point where banking can occur 24 hours of a day (SABRIC, 2016b). ATMs have significantly reduced the manual workload of the bank tellers inside banks' branches. The ATM technology has evolved from being a service that was once only available to a select group of customers, and equipped with limited functionalities, to one that now allows for envelope deposits, to envelope-less deposits, to specific customer-set preferences, and network capabilities (Stewart, 2015:20; Totty, 2015:42). These improvements in ATM functionality now also include video technology and alternative ways of authenticating a customer through biometric devices such as thumbprints, fingerprints and retinal scans (Stewart, 2015:20; Totty, 2015:42).

3.3.3 Electronic card payments

Card payments are also a common way of conducting bank transactions: customers use a debit card or credit card to make payments for goods or services acquired, and this is especially common within the e-commerce sector of the economy (Bahnsen, Aouada, Stojanovic & Ottersen, 2016:134; Lepoivre, Avanzini, Bignan, Legendre & Piwele, 2016:34; SABRIC, 2016c). As a result of the now global reach of e-commerce, customers can easily conduct cross-border transactions from anywhere in the world: their online card purchases are concluded in a few easy steps, by entering their card login credentials in the online or e-commerce platform in order to initiate a valid transaction (Van Vlasselaer, Bravo, Caelen, Eliassi-Rad, Akoglu, Snoeck & Baesens, 2015:38). Payments can also be made by "swiping" the customer’s debit or credit card through a point of sale device at a merchant. The transaction is concluded because the magnetic strip at the back of the card or the micro-chip on the front contains the requisite (and sensitive) data about the customer’s personal bank account (SABRIC, 2016c).

3.3.4 Internet banking

Another outcome arising from the adoption of technological advances in the banking industry is that of internet banking (SABRIC, 2016d). Customers that embrace the use of internet banking can access and manage their finances 24 hours a day, 7 days a week from any location in the world that is connected to the internet, by using their computers, tablets and smartphones (Jarret, 2015:1; Takieddine & Sun, 2015:361). In addition, internet banking is a convenient way of conducting their banking for those who want to avoid long queues inside the physical bank branches. Internet banking also enables customers to have up-to-date, real time information regarding their finances. Banks that provide their customers with internet banking capabilities benefit from reduced transaction costs, improved services to customers, meeting consumer demands, and creating transactional efficiencies (Montazeni & Qahri-Saremi, 2015:210).

3.3.5 Mobile banking

Valcke (2016:11) indicates how recent and ongoing technological advances, and specifically “mobility” of access to a host of services, have transformed the way we live, work and play. The notion of “mobility” is evident within the banking industry in that “mobile banking” can already be conducted by using computers, tablets and smartphones (Peres, 2015:215; SABRIC, 2016e; Takieddine & Sun, 2015:361). Mobile banking was one strategy pursued by the banking industry in response to increasing customer demands for remote, real-time access to information and services from their banks (Peres, 2015:215). Mobile banking is already evolving beyond the traditional services of receiving message alerts for transaction processing and statement balance updates; the more sophisticated uses now include the ability to transfer funds, and effect remote invoice payments and remote deposits (Valcke, 2016:10).

The unique nature of the business of banks makes it necessary for banks to utilise technology optimally in their delivery of services to the bank-using community of a country. The expanding use of technology by the banking industry, as is apparent from the earlier examples, confirms the transformation of paper based audit evidence to electronic evidence, as was discussed in section 3.2. The use of technology by the banking industry brings with it significant advantages (as mentioned previously): such advantages include increased efficiencies in transaction processing and seamless real-time banking experiences to its customers, and offers the bank a competitive advantage over its rivals through increased productivity. On the other hand, the use of technology also creates opportunities for fraudsters and others to undermine the integrity of the system. Table 3.2 provides examples of fraud risk incidents related to each of the bank technologies that were highlighted earlier.

Table 3.2: Bank technology and related fraud risk incidents

BANK TECHNOLOGY	FRAUD RISK INCIDENTS
ERP Systems	Processing of invalid or fraudulent transactions as a result of segregation of duty violations by users of the system (Singh, Best, Bojilov & Blunt, 2014:289).
ATMs	Fraudulent activities such as card skimming (i.e., where the customer’s bank card details are copied or replicated through special devices); swapping of cards; ATM “shoulder surfing” whereby a perpetrator obtains a customer’s pin and/or login details by looking over the customer’s shoulder while they are performing a cash withdrawal, and the trapping of cards inside ATMs (Totty, 2015:42; SABRIC, 2016b).

BANK TECHNOLOGY	FRAUD RISK INCIDENTS
Electronic Card Payments	Use of illegally manufactured cards with information stolen from the magnetic strips of the original and legitimately issued bank cards (Lepoivre *et al*., 2015:34; SABRIC, 2016c). Credit card fraud in South Africa decreased by 28.6% from R353.3m in 2014 to R252.2m in 2015. Although a noticeable decrease in credit card fraud has been observed, it is still a significant amount of the reported card fraud in 2015. Debit card fraud however, has increased by 8.3% in the same period (SABRIC, 2016f).
Internet and Mobile Banking	Unauthorised access to a customer's online banking profile by illegitimately obtaining the customer's personal login credentials through their response to a fictitious e-mail, for example, that has been sent to a customer prompting the customer to respond and disclose confidential information (Peres, 2015:214; SABRIC, 2016d; Valcke, 2016:10).

(Source: own deduction)

It is the occurrence of risk events like these (as indicated in Table 3.2) that can result in organisations (and in this case banks) not achieving their set objectives. It is therefore not surprising to also see cyber-crime and technology risks featured among the top 10 risks facing the global banking industry (as mentioned in section 2.5.1). It is within this "electronic" control environment that the internal audit function now has to conduct its duties in order to obtain audit evidence that will lead to meaningful analysis and quality recommendations for its diverse mix of stakeholders throughout an organisation. COSO (2013:31) defines the control environment as follows: *"The control environment comprises the integrity and ethical values of the organisation; the parameters enabling the board of directors to carry out its oversight responsibilities; the organisational structure and assignment of authority and responsibility; the process for attracting, developing, and retaining competent individuals; and rigor around performance measures, incentives, and rewards to drive accountability for performance. The resulting control environment has a pervasive impact on the overall system of internal control."*

The different uses of technology by the banking industry (which form an integrated part of the overall control environment, as highlighted earlier), have one common element that underpins and drives the successful processing of a transaction: "data". Electronic data has brought about the transformation of audit evidence from paper-based to its present form as electronic media-based evidence (as discussed in section 3.2). Deloitte (2016c:2), in their report on *Internal Audit Analytics: The journey to 2020* stresses how important it is that internal audit functions embrace the vast amount of data within today's organisations (the notion of big data in the banking industry was emphasised in sections 1.1 and 3.1) by applying innovative techniques that are able to provide broader audit coverage, and can deliver greater insight into risks and controls. Coderre (2015:39) goes on to observe that the use of data analytics will provide internal audit functions with oversight, insight and foresight regarding their respective organisations' risk landscapes. By doing this, internal audit functions are totally redefining traditional audit techniques (refer to section 2.2.6) that were once (but are no longer) sufficient to conduct internal audit engagements. It is therefore imperative for internal audit functions to integrate the use of technology-enabled tools into their audit methodologies if they want to retain the status of a value-adding assurance function within their organisations.

3.4 COMPUTER ASSISTED AUDIT TECHNIQUES (CAATS) – AN OVERVIEW

The period between the late 1950s and early 1960s can be classified as the era when auditors believed that the use of their minds, pens, pencils and adding machines was sufficient enough for successfully conducting their audit tasks (Will, 1995:1). Historically, internal audit functions mainly performed their auditing tasks "around the computer" (Boutell, 1965:41; Lockman & Minsky, 1984:52; Kotb *et al.,* 2014:46). This practice was quite common in the traditional audit environment that was dominated by paper based audit evidence (also refer to section 3.2). This practice of auditing "around the computer" was a manual effort-intensive audit approach and involved the inspection and verification of a limited sample of paper based documents such as invoices, purchase orders, billing records and inventory listings (Lanza, 1998:33; Braun & Davis, 2003:725; Alles, 2015:442; KPMG, 2015b:12; Elefterie & Badea, 2016:307). In other words, the internal auditor's conducted their tests of controls procedures and verification procedures as if the entire control environment was solely based on manual methods. Thus, it should be clear that the internal auditor literally audited controls that existed "around" the computer, bypassing the controls that may or may not have existed within the computer system. This audit approach may have served its purpose in the era where the volumes of data did not overwhelm organisations' systems or operations. But this may no longer be the case in this technology- and data-driven modern era. However, the realisation of the magnitude of the impact of technology on the audit function soon necessitated a change in the auditing landscape as can be seen from the implementation and evolvement of the computer as an "audit tool" to assist in conducting a variety of auditing tasks since the late 1960s (Porter, 1969:54; Mahzan, Muhamad, Yahya & Shahimi, 2009:38; Pedrosa *et al.,* 2015:1). The prominence of the use of CAATs and GAS by auditors is evident in the number and diversity of the studies that have focused attention on the use of computers as an "audit tool" by auditors since the 1970s. For example, Adams and Mullarkey (1972) conducted one of the earliest surveys on the use of audit software. Another study by Cash, Bailey and Whinston (1977) focused on the techniques required for auditing electronic data processing accounting information systems. The period between the late 1980s and early 1990s saw the evolvement of the microcomputer as an "audit tool", in that it made the assessment of controls over input data, and the processing of actual data and the verification of the validity of the output generated, easier and more economical (Coderre, 2009:8). As a result, it enabled auditors to have access to electronic data anywhere and at any time.

The transformation of the internal audit function and the growing imperative to adopt technology-enabled tools and techniques (such as the use of CAATs) was emphasised in sections 2.2.5, 2.2.6, 3.1 and 3.2. In addition, the notion of "big data" and the impact thereof on organisations and the internal audit function was also highlighted in sections 1.1, 3.1 and 3.2 respectively. In the words of W.E. Deming: *"Without data you're just another person with an opinion"* (cited in Cangemi, 2016:1). It is thus of utmost importance that contemporary internal auditors utilise appropriate tools and techniques in order to embrace the power of data so that meaningful analyses of the data (electronic audit evidence) may be effected (IIA, 2016o:1; PwC, 2016:11; Zitting, 2016:2). Such practice should lead to enhanced audit results and should enable internal audit functions to present reports with veracity and impact. Therefore, in an effort to stay abreast of technological advances internal audit functions have been compelled to look at innovative techniques in order to ensure they remain able to deliver on their mandate. It should therefore not be surprising to note (as reflected in section 2.2.5) a general increase (CAATS being a minor exception) in the use of technology-enabled tools and techniques by internal audit functions over the 10 years since 2006, in order to allow them to audit "through" and "with" the computer, rather than "around" the computer, as was previously mentioned. One of the prominent technology-enabled tools that is available to internal audit functions that enhances the gathering of audit evidence from data that is mainly available in electronic format is CAATs.

CAATs include a broad definition. The most prominent definitions, amongst others, include those by Braun and Davis (2003:726): they define CAATs as the use of any technology that enables an auditor to conduct auditing tasks. Coderre's (2009:5) definition highlights CAATs as those technology-enabled tools and techniques that increase the efficiency of the conduct of audits. Furthermore, the IAASB (2015:17) defines CAATs as the audit procedures applied using the computer as an audit tool during the execution of an audit. These definitions therefore "allow" internal auditors to embrace the power of data by auditing "through" the computer. This means that controls embedded in the computer system can now be tested and larger samples (including whole population analysis of data) can be thoroughly interrogated and analysed by the internal auditor (the different functions of an array of CAATs, with specific emphasis on GAS as the primary (most frequently used) CAAT, is discussed in section 3.5.1). In addition, the use of CAATs enable internal auditors to audit "with the computer" and thus to perform a variety of auditing tasks efficiently and in a limited time frame (Ahmi, 2012:38; Elefterie & Badea, 2016:307). Braun and Davis (2003:726) distinguish between five popular categories of CAATs. These categories are: test data; integrated test facility; parallel simulation; embedded audit module, and GAS (refer to section 3.4.2 for a brief discussion on the different types of CAATs). Of these five categories GAS is the most frequently used CAAT and is also the focus of this study (as was mentioned in section 1.2) (Braun & Davis, 2003:725; Debreceny *et al.,* 2005:605; Kim *et al.,* 2009:215; Lin & Wang, 2011:777; Mahzan & Lymer, 2014:328; IIA, 2016o:56). Section 3.5 provides a discussion of the use of GAS by internal auditors.

Section 3.1 made reference to the fact that internal auditors have to embrace the power of data that resides in the computer systems of their respective organisations if they are to remain relevant in the era of "big data". The use of CAATs enables internal audit functions to perform in-depth analyses of organisations' data. Soileau *et al*., (2015:11) define data analytics as follows:

> *"Analytics is the science of analysis. Analysis is the process of disaggregating information into smaller parts to gain a better understanding of the data. Analytics should typically be a view from the top down to the detail. This allows for the analysis to be put in context. Isolation of data patterns often allows for improved visualization, thereby both supporting and improving the decision-making process. The use of analytics also provides for data-driven decision making, based on real-time insights into data. The use of such techniques will help draw a picture that demands attention. Although a variety of substantive evidence gathering procedures are needed to establish a causal relationship between financial and operational data, such a process is valuable in identifying and assessing risk to improve both audit efficiency and effectiveness."*

Also recognising the value that is attainable through data analytics (as is evident from the definition provided), Coderre (2015:39) points out that the use of data analytics can assist internal auditors to audit an organisation from a data-driven perspective (answering the question: what does the data reveal about the organisation?), drive understanding of the risks (answering the question: what is happening?), and to generate insight (answering the question: why is it happening?). Deloitte (2016c:2), in their report on *Internal Audit Analytics: The journey to 2020,* supports this view and indicates that an analytics-embedded internal audit function will be valuable in determining “how” to audit, “what” to audit and “when” to audit. Section 3.4.1 provides a brief discussion in which the traditional, manual auditing techniques are compared with those making use of technology-enabled tools and techniques such as CAATs. Section 3.4.2 then highlights the different types of CAATs available to internal audit functions.

3.4.1 Traditional manual auditing vs. CAATs

The traditional practice of gathering audit evidence for tests of controls purposes by internal audit functions typically relied on the selection of a sample of data or information from the underlying control environment (also refer to section 2.2.6) (Ahmi, 2012:40; Deloitte, 2013:3; KPMG, 2015b:12; O’Donnell, 2015:24; Ramlukan, 2015:16). In addition, Smidt (2014:228), in his study on the use of sampling techniques by internal audit functions in the South African banking industry, found that 100% of the respondents were still employing traditional sampling techniques (whether statistical or non-statistical) for gathering audit evidence for tests of controls purposes. There is nothing wrong with the use of these sampling techniques when applied correctly and within the context of the respective engagement objective. However, with the advancement of technology (as has been emphasised in sections 1.1 and 3.1) internal audit functions have to become cautious and fully conscious of the limitations of traditional audit methods (such as sampling techniques) when compared to the potential of other techniques such as CAATs. For example, the use of sampling provides for a manual-intensive audit approach and reveals point-in-time, retrospective, and limited views of exceptions, control breakdowns, and/or risk for a small percentage of an organisation’s risk universe (Deloitte, 2013:3; KPMG, 2015b:12; Leech, 2015:48; O’Donnell, 2015:24; Ramlukan, 2015:16; Shamsuddin *et al.,* 2015:124).

On the other hand, the use and adoption of CAATs by internal audit functions should result in a number of additional benefits. The functions and benefits of GAS (as the primary CAAT) are discussed in more detail in section 3.5.1. Probably the most important of these benefits, amongst others, are that it allows data analytics to be used on the data for audit testing purposes. The most commonly used CAATs for data analysis purposes are Microsoft Excel, GAS packages (particularly ACL, and Interactive Data Extraction and Analysis (IDEA)), and Microsoft Access (Lin & Wang, 2011:777; Ahmi & Kent, 2013:90; Mahzan & Lymer, 2014:338). In addition, the IIA's Research Foundation (2016o:56), in their 2016 (CBOK) report on *Data Analytics: Elevating Internal Audit's Value*, found that 77% of respondents use Microsoft Excel for basic data analysis, while 53% of the respondents use specialised GAS packages such as ACL and IDEA with 37% that use Microsoft Access for data analysis purposes. The application of analytics enables internal audit functions to provide proactive audit results representing 100% of the audit population under review in a few minutes or hours (rather than days or weeks as is the case of sampling). Furthermore, it allows for comprehensive and in-depth analysis of the data (which should result in more sophisticated risk analysis and monitoring), and assists with the identification of outliers and anomalies so that audit effort can be focused on those areas of highest risk (Ahmi, 2012:40; Deloitte, 2013:3; Leech, 2015:48; O'Donnell, 2015:24; Protiviti, 2015b:2; Soileau *et al.,* 2015:12). These benefits, arising from the application of CAATs as part of the internal audit function's methodology, were also confirmed in the study conducted by Smidt (2014:152) on the use of sampling techniques by internal audit functions in the South African banking industry. In this study 90% of respondents indicated that the use of CAATs (specifically GAS) could be "utilised more frequently" within their respective departments. The responses quoted are representative of the situations in the banks' internal audit departments at that time:

- *"We are currently engaged in a comprehensive CAATs project to consider CAATs on all engagements and [to] move towards 100% examinations, and away from sampling where feasible and efficient.*
- *Will allow audit procedures to be more risk focused.*
- *We are in the process of expanding our use of CAATs to include continuous auditing and [to be] in line with our strategic objective of eventually moving the*

Continuous Auditing CAATs into the client environment as a key control (continuous monitoring).

- *Lack of knowledge limits the use thereof. Continuous use thereof will ensure maturity in the use of CAATs.*
- *The use of technology, including CAATs, is a non-negotiable element of our audit approach in order to enhance the audit process and increase value to our client.*
- *We don't make sufficient use of CAATs for continuous monitoring purposes. We do use CAATs on some of the audits. Data analytics is currently a key priority to extract and enhance efficiencies.*
- *We use ACL but only in a limited manner and a more defined Data Analytics policy and roll-out to the business auditors by the IT auditors would allow ACL to be used more widely.*
- *Always room for improvement – Continuous journey of up-skilling all to apply and utilize CAATs."*

With reference to the earlier discussion it should be clear that traditional audit approaches do not allow for the same in-depth interrogation of data compared to using CAATs. As mentioned in section 3.1, Zitting (2016:2) and the IIA (2016:1) draw attention to the limitations of traditional internal audit approaches in the present technological, data-driven era and caution internal audit functions to adopt technology-enabled tools in their internal audit methodologies, or run the risk of becoming obsolete. In addition, Chang, Wu and Chang (2008:211) remark that traditional (manual) audits cannot immediately identify discrepancies, unlike the abilities inherent in computer auditing techniques, and therefore emphasise the criticality of employing CAATs as part of the audit methodology in testing the internal controls within an organisation's control environment.

3.4.2 A brief overview of the different types of CAATs

With reference to the broad definition of CAATs presented in section 3.4, it should be clear that CAATs covers a variety of types of technology-enabled tools and techniques. A review of the literature distinguishes between five popular types of CAATs, namely: test data; integrated test facility; parallel simulation; embedded audit module, and GAS (Braun & Davis, 2003:726; Jaksic, 2009:10; Coderre, 2009:8; Ahmi, 2012:41; Cerasela & Alina, 2013:1499; Kiesow, Zarvic & Thomas, 2014:905; Elefterie & Badea, 2016:307). Each of these types of CAATs as derived from the various CAATs literature is briefly discussed next.

3.4.2.1 Test data

This method uses fictitious input data that is developed by the internal auditor to test possible transactions and scenarios that are generated through the actual processing of an application within the respective organisation's systems. In other words, the internal auditor determines expected output to be generated by the computer application based on certain control criteria prior to entering the fictitious input data. The output generated by the computer application is then compared to the internal auditor's expected results in order to identify whether the processing of a specific transaction is correct or incorrect. Test data tests for control problems that may reside within the organisation's computer system.

3.4.2.2 Integrated test facility

With the integrated test facility, the internal auditor will again make use of fictitious input data in order to determine any unexpected results by comparing the output generated by the computer against its own expected results. It differs from the test data method in that this method integrates the fictitious data (which is flagged by the internal auditor for identification purposes) so that it is processed simultaneously with actual data, under normal circumstances. This result then allows the internal auditor to evaluate the effectiveness of application controls during normal operations.

3.4.2.3 Parallel simulation

With this type of CAAT the internal auditor does not make use of fictitious test data, unlike the test data and integrated test facility approaches discussed earlier. In this case, the internal auditor uses the client's actual, unprocessed data and processes it through their own proprietary application that is intended to replicate the output of the client's application. A comparison of the outputs generated by the internal auditor's application to the output generated by the client's application then enables the internal auditor to analyse and draw meaningful conclusions regarding the effectiveness of the functioning and processing controls that reside within the client's application.

3.4.2.4 Embedded audit module

As the name suggests, in this approach the internal auditor embeds or implements an "audit module" into a client's system. This involves the identification of transactions that deviate from predetermined criteria, and that are then flagged for further emphasis by the internal auditor during the processing of the live or actual data by the client's application. This enables the internal auditor to identify anomalies in real-time, as and when the transactions occur.

3.4.2.5 Generalised Audit Software

Of the mentioned CAATs, (refer to section 3.4) GAS is the most frequently used CAAT: it allows for data extraction, querying, manipulating, summarising and analysis of data (Braun & Davis, 2003:725; Debreceny *et al.,* 2005:605; Kim *et al.,* 2009:215; Lin & Wang, 2011:777; Mahzan & Lymer, 2014:328; IIA, 2016o:56). The focus of this study is on the use of GAS by internal audit functions (as was stated in section 1.2), and GAS is therefore discussed in more detail in the next section.

3.5 GENERALISED AUDIT SOFTWARE (GAS)

The International Standards for the Professional Practice of Internal Auditing, through Standard 1220.A2, *Due Professional Care*, encourages internal auditors to utilise technology-based tools (as mentioned in section 1.1) during the conduct of internal audit engagements. Among these technology-based tools, and specifically required by the Standards, is the use of GAS. As mentioned in section 3.4, GAS is a sub-category within the broader definition of CAATs. It also happens to be the type of CAAT that is most frequently used by internal auditors compared to all the other commonly known types of CAATs that were identified in section 3.4.2. Ahmi (2012:42) points out that the abbreviation "GAS" is used somewhat inconsistently throughout the CAATs and auditing literature. Authors sometimes refer to the use of CAATs when in fact they are referring to the use of GAS. In more specific terms, GAS focuses more on data which is going to be accessed, retrieved, analysed and manipulated from the computerised systems for tests of controls purposes. GAS includes, amongst others, professional audit software packages such as ACL and IDEA (refer to section 3.4.1).

With the advancements in technology now being used by organisations, and specifically in the banking industry, and with the flourishing of the era of "big data" (as was emphasised in sections 1.1 and 3.1 respectively), one would think that the adoption and general use of technology-based tools, and more specifically the use of GAS, would be a non-negotiable element of any modern internal audit function's "toolkit", as they support their efforts to add value to meet their various stakeholders' expectations. Surprisingly, however, this is not the case, as can be discerned from examining the results of the IIA's Research Foundation CBOK 2015 report (the largest ongoing study of internal audit professionals in the world). The global results (IIA, 2015a:6) reflected in their 2015 (CBOK) report on *Staying a step ahead: Internal audit's use of technology* indicate that the extensive use of technology-based tools by internal audit functions is the exception rather than the norm. More specifically, the results indicate that 52% of the respondents either do **not** use CAATs at all, or only use it to a minimal extent. This low level of maturity displayed in the use of CAATs by internal audit functions globally is also reflected in its report (IIA, 2016m:6) on *Regional Reflections: Africa*, where 57% of respondents (specifically from South Africa), indicate that their internal audit functions only utilise technology-based tools such as CAATs "to some extent", or worse, rely solely on manual interventions in the execution of their duties.

In addition, the professional accounting and auditing firms have also focused attention on the use of technology-based tools, and specifically auditing software for data analysis purposes, by internal audit functions. The PwC (2015:6) report, *2015 State of the internal audit profession study – Finding True North in a period of rapid transformation,* found that only 34% of internal audit functions are making use of data analytics as part of their internal audit engagements. A prior study (also by PwC (2013b:2)) on *The Internal audit analytics conundrum – finding your path through* *data,* found that only 31% of internal audit functions were then making use of data analytics in the form of audit software in efforts to improve delivery on their mandate. Another study conducted by Protiviti (2015a:19) in the USA *(From Cybersecurity to Collaboration: Assessing Top priorities for internal audit functions)* confirmed that CAATs remains a top priority for internal audit functions: improving the function's skillset so as to be able to use technology-enabled tools and techniques. Deloitte (2016c:2), in their report on *Internal Audit Analytics: The journey to 2020* stresses how important it is for internal audit functions to embrace the vast amounts of data within today's organisations by applying new and innovative techniques that facilitate broader audit coverage and enable the delivery of greater insight into risks and controls.

Furthermore, KPMG (2015b:12), in their report entitled *KPMG Internal Audit: top 10 considerations for technology companies,* highlights the use of technology and data analytics as one of the top 10 considerations that internal audit functions must master in their efforts to enhance their audit approaches and thus to deliver greater insight and value to their stakeholders. In another research report specifically focused on the use of data analysis audit software by internal audit functions, and conducted by AuditNet (2012:1), it was indicated that the majority of internal audit functions are still only utilising data analysis audit software on an ad hoc basis. The report also observed that internal audit functions still have a long way to go in order to reach a level of maturity beyond the ad hoc stage with regard to the use of data analysis audit software. Furthermore, Smidt (2014:152), in his study on the use of sampling by internal audit functions in the South African banking industry, found that 90% of respondents indicated that the use of CAATs (specifically GAS) could be "utilised more frequently" within their respective departments.

Despite the low maturity rates reported on the usage and adoption of GAS by internal audit functions, and the recurring statement of intention to increase its usage as reported in the various studies cited earlier, the use of GAS does hold many advantages for internal audit functions seeking to improve efficiencies and insights during their day-to-day activities. These advantages, including the motivational factors for adopting GAS by internal audit functions, are discussed in section 3.5.1. However, despite the overall beneficial effects of embracing GAS, there are also some limitations or disadvantages associated with the use of GAS, and these are usually cited by internal audit functions as the reasons for not adopting GAS. These limitations and causal factors as identified in various research studies into the process of adoption of GAS by internal audit functions are discussed in section 3.5.2.

3.5.1 Functions and advantages of GAS as contributing factors motivating the adoption thereof by internal audit functions

The adoption and use of GAS offers a number of data analysis functions to internal auditors. Table 3.3 provides a summary of the most common functions associated with the use of GAS. This summary has been compiled from literature on GAS and various other auditing perspectives (Debreceny *et al.,* 2005:608; Janvrin *et al.,* 2009:110; Ahmi & Kent, 2013:90; Tumi, 2014:3; Bierstaker, Janvrin & Lowe, 2014:4; Mahzan & Lymer, 2014:338; Shiau, 2014:22; Banarescu, 2015:1829; IAASB, 2015 ISA 610 par. A16 & A27; Murphy & Tysiac, 2015:2; O'Donnell, 2015:24; Pedrosa *et al.,* 2015:2; Shamsuddin *et al.,* 2015:124; Zaiceanu, Hlaciuc & Lucan, 2015:601; Ahmi, 2012:43; Cangemi, 2016:1; Elefterie & Badea, 2016:305; IIA, 2016o:58).

Table 3.3: Functions of GAS

FUNCTION	DESCRIPTION
Aging analysis	Produces aged summaries of data based on established cut-off dates. For example, to identify the number of days outstanding for accounts receivable transactions.
Merge	Combines two files with identical fields into a single file. An example would be to merge two years' worth of accounts payable history into one file.
Calculations	Creates a calculated field using data within a file. For example, the net salary to an employee can be recalculated using the gross pay field and deducting statutory deductions.
Cross tabulate	Allows the internal auditor to analyse character fields by setting them in rows and columns. By cross tabulating character fields, the internal auditor can interrogate the

FUNCTION	DESCRIPTION
	data, explore areas of interest, accumulate numeric fields and produce various summaries.
Digital analysis/Benford's law	Audit technology designed to find abnormal duplications of specific digits, digit combinations, specific numbers, and round numbers in company data. Since the objective is to find abnormal duplications, internal auditors need a benchmark that indicates a normal level of duplication. Benford's Law gives internal auditors the expected frequencies of the digits in tabulated data. The internal auditor would expect conformity from data that is original and that has not been tampered with. Any deviations from the normal (expected) patterns within such data can be red flagged for the internal auditor to analyse further.
Duplicates	Identifies duplicate transactions or records in a file. For example, the identification of duplicate bank account numbers within the payroll master file.
Export	Enables the internal auditor to save a file in another format (for example, Excel or Word) for testing purposes.
Filter	Allows the internal auditor to extract specific items from a file and to copy them to another file. For example, identifying accounts payable balances over a specified limit.
Gaps	Enables the internal auditor to test for any missing transactions from a file.
Sort	The sort functionality allows the internal auditor to sort transactions or records in a file in ascending or descending order. For example, the human resources master file can be interrogated for any blank ID number fields or ID number fields that are displayed as "99999999".
Join	This function joins two different files into a single file using specific key fields. For example, the number of employees

FUNCTION	DESCRIPTION
	that are still active on the organisation's network firewall can be compared to the employee master file to determine if any of these employees have not already terminated their employment with the organisation. If any cases are identified, the terminated employees' access to the firewall should immediately be revoked.
Regression	This function enables the internal auditor to draw a regression analysis using statistical means to calculate a dependent variable (such as net sales) based on various independent variables (for example, product purchases, inventory levels and number of purchases).
Sample	Allows for the selection of samples from key electronic files.
Statistics	Calculates various statistics on a selected numeric field. For example, positive values, negative values and averages.
Stratify	Stratification counts the total number and Rand value of a population falling within specified intervals. It also allows a useful view into the largest, smallest and average Rand value transactions.
Summarise	Assists the internal auditor to make a summary of numerical fields based on a specific field in a file. For example, the internal auditor can summarise travel and entertainment expenses for a specific employee to identify any unusual high payment amounts.
Highlight differences	Highlights differences between two different versions of a report.
Outlier extraction	Searches for records that lie at the extreme ends of a population (e.g., all invoices that exceed the average for a given supplier).

(Source: own deduction)

Reviewing the information in Table 3.3, it is clear that GAS functionalities provide the internal auditor with various options that can result in the function conducting a more streamlined and enhanced audit engagement. The application of the GAS functions should enable the internal auditor to analyse and draw meaningful conclusions from and insights into the data about the effectiveness of an organisation's control environment. Section 2.2.5 made reference to the increased pressure that is being placed on internal audit functions as a result of the advances in the technology used by organisations, including (and exacerbated by) the rising expectations of its key stakeholders who require an increase in audit coverage in an effective and efficient manner. Deloitte (2013:4), in their report entitled *Adding insight to audit – Transforming internal audit through data analytics* also draws attention to the expectations of the audit committee and senior management that have also been heightened in tandem with the adoption of GAS:

- the internal audit function is expected to be more efficient and to achieve more with less;
- the internal audit function is expected to be more effective in identifying and responding to risk;
- the internal audit function is expected to deliver more robust and effective analysis of key issues;
- the internal audit function is expected to provide meaningful insights and analysis; and
- the internal audit function is expected to be a change agent within the organisation.

In addition, Baker (2009b:30) points out that in today's challenging economic environment internal audit functions globally are under pressure to maximise their efficiency. This pressure has not lessened: internal audit functions need to realise the advantages brought about by the adoption and use of GAS. Some of the most common advantages associated with the use of GAS and identified in various auditing - and GAS-related research publications include:

- GAS introduces an enhanced audit approach as it allows for faster, more efficient conduct of internal audit engagements (usually in a fraction of the time that traditional audit approaches require);
- it enables the internal auditor to identify and analyse internal control weaknesses;
- it allows for the performance of data analytics;
- it allows for a proactive audit approach that can deliver audit results in real-time - as and when internal control weaknesses are identified;
- it has the ability to test significant volumes of data;
- GAS allows for broader coverage of an organisation's risk and control universe;
- GAS facilitates the evaluation of fraud risks;
- the ability to test and analyse 100% of an audit population instead of only a sample;
- GAS enables the internal auditor to gather sufficient and reliable audit evidence regarding the operating effectiveness of an organisation's control environment;
- GAS assists the internal auditors with risk assessments for tests of controls purposes through the identification of outliers or anomalies, and trends that warrant further emphasis on those areas of higher risk; and
- it assists the internal audit function to satisfy the client's demand for fast and reliable audit results (Janvrin *et al.,* 2009:110; Ahmi, 2012:40; Ahmi & Kent, 2013:90; Bierstaker *et al.,* 2014:4; Mahzan & Lymer, 2014:338; Shiau, 2014:22; Coderre, 2015:39; IAASB, 2015 ISA 610 par. A16 & A27; Murphy & Tysiac, 2015:2; O'Donnell, 2015:24; Pedrosa *et al.,* 2015:2; Shamsuddin *et al.,* 2015:124; Zaiceanu *et al.,* 2015:601; Elefterie & Badea, 2016:305; IIA, 2016o:58).

Although the use of GAS offers many functionalities and advantages to internal audit functions, its use and adoption is still lower than expected, as was emphasised in section 3.5. Coderre (2015:40) remarks: *"Study after study has shown that the data analytics capabilities of internal audit functions consistently fall below what is desired and even what is required."* There is however a group of leading internal audit functions that do embrace the power of data analytics through the utilisation of GAS in an effort to respond to the increased demands of its various stakeholders. These internal audit functions usually cite the advantages described earlier as some of the contributing drivers for adopting GAS as an essential tool in their audit approaches.

In addition, Table 3.4 provides a summary of selected research studies that have focused specifically on the motivational factors that contribute to the adoption and/or use of GAS by internal audit functions.

Table 3.4: Summary of selected major studies that explored the use of GAS by internal audit functions

YEAR OF STUDY'S PUBLICATION	AUTHOR/S	TITLE OF STUDY	KEY FINDINGS (MOTIVATION FOR ADOPTING GAS)
2005	Debreceny *et al.*	Employing generalised audit software in the financial services sector: challenges and opportunities	• Internal auditors see the use of GAS primarily as a tool for special investigations rather than as a foundation for their regular, day-to-day work requirements.
2008	Mahzan and Lymer	Adoption of Computer Assisted Audit Tools and Techniques (CAATTs) by Internal Auditors: Current issues in the UK	• Improved audit coverage in an efficient manner; and • Reduced costs in conducting internal audit engagements.

YEAR OF STUDY'S PUBLICATION	AUTHOR/S	TITLE OF STUDY	KEY FINDINGS (MOTIVATION FOR ADOPTING GAS)
2012	AuditNet	2012 Survey Report on Data Analysis Audit Software	• More audits can be conducted; • Increased audit efficiency (i.e., a more streamlined audit process); • Ability to review entire audit populations; • Identification of fraudulent transactions; • Auditors enjoy using the software; • The audit scope is more consistent; • The ability to do more with less; • It has reduced the amount of scheduled fieldwork; and • The internal audit staff acquire new skills.
2014	Mahzan and Lymer	Examining the adoption of computer-assisted audit tools and techniques: Cases of generalized	• Increased cost savings; • Broader audit coverage; • Increased audit quality; • The use of GAS enhances the audit efficiency; and • The use of GAS allows for automated audit tasks to be conducted.

YEAR OF STUDY'S PUBLICATION	AUTHOR/S	TITLE OF STUDY	KEY FINDINGS (MOTIVATION FOR ADOPTING GAS)
		audit software use by internal auditors	
2015	Protiviti	Changing trends in internal audit and advanced analytics	• Testing support for specific audits; • Sample selection; • Risk assessment; • Audit planning; and • Continuous monitoring.
2015	Shamsuddin *et al.*	Factors influencing usage level of computer assisted audit techniques (CAATs) by internal auditors in Malaysia	• Increase the audit efficiency; • Increase the quality of the audit work performed; • Improved communications as a result of the various functionalities and capabilities of GAS; and • GAS is easy to use.
2016	IIA	Data Analytics: Elevating Internal Audit's value	• The audit process is streamlined; • The fieldwork time for the engagement is reduced; • Fraudulent transactions are identified; • The audit scope is more consistent; and

YEAR OF STUDY'S PUBLICATION	AUTHOR/S	TITLE OF STUDY	KEY FINDINGS (MOTIVATION FOR ADOPTING GAS)
			• More audits are capable of being performed.

(Source: own deduction)

Reviewing the information in Table 3.4 it is evident that "enhanced audit efficiency", amongst others, was consistently cited as the reason for adopting GAS. This aligns positively with the increased expectancy of the internal audit functions' stakeholders (also refer to section 2.2.5) that internal audit provides broader (extended) audit coverage in an effective and efficient manner. The factors discussed in this section focused on the positive aspects of the functionality, advantages and usage of GAS by internal auditors. There is however also factors that render internal audit functions reluctant to implement, or that persuade them to make only limited use of GAS. These factors are discussed in the next section.

3.5.2 Limitations and disadvantages of using GAS precluding the adoption thereof by internal audit functions

Despite the number of advantages and functionalities that the use of GAS may offer (as mentioned in section 3.5.1) there are also certain causal factors that prevent internal audit functions from fully utilising them. Various studies have been conducted in which the use and adoption of GAS by internal audit functions (also refer to Table 3.4) has been investigated. These studies have also identified the reasons or factors most frequently cited for not integrating GAS and data analytics into the internal audit methodology.

Mahzan and Lymer (2008:21), in their study on the *Adoption of Computer Assisted Audit Tools and Techniques (CAATTs) by Internal Auditors: Current issues in the UK,* highlight the following major challenges experienced by internal audit functions, and used as justification for not fully utilising or integrating GAS as part of their internal audit methodologies: training of employees on the use of GAS; concerns regarding compatibility between the GAS and the department’s other systems, and the ability of the individual GAS to satisfy the data manipulation needs of the audit departments.

The survey conducted by AuditNet (2012:9) specifically focused attention on the importance of factors that influence the successful adoption and integration of GAS and data analysis into the audit process. The top three factors identified were, data quality and reliability, availability of access to the data, and support and buy-in from the CAE.

The report issued by KPMG (2013:10) entitled *Data analytics for internal audit,* highlighted data availability (the variety of disparate information systems with multiple formats, incomplete data sets and inconsistent data quality), and the resulting inability of the selected GAS to effectively leverage its data analytics potential as the main challenges experienced by internal audit functions, and their justification for not adopting GAS and its data analysis capabilities.

PwC in their 2013 report (PwC, 2013b:3) present a slightly different set of issues that internal audit functions have offered as justification for not yet having fully embraced the auditing power that data analytics makes possible with the use of GAS. The challenge begins when trying to build and acquire a team with the right data analytical skills set; embedding the use of data analytics across the internal audit life-cycle is the next challenge; identifying and acquiring the appropriate software technology is no less daunting, and the final barrier is achieving access to complete, relevant and accurate data in a timely manner.

The white paper issued by ACL (2013:4) also emphasises data access as a major barrier to the successful adoption and/or integration of GAS by internal audit functions. In addition, the time and resources required to achieve the implementation of GAS, as well as the absence of senior audit management’s support and buy-in were also cited as contributing challenges to internal audit functions’ efforts to adopt and integrate GAS into their audit methodologies. The authors also point out an additional challenge to the acceptance of GAS: the existence of an expectation gap between management’s and internal audit’s views as to what is important regarding the status of the control environment, as derived from the data analysis. For example, management (the auditee) is usually more interested in performance-based issues, while internal control weaknesses are the area of greater interest for internal audit.

In Tumi's study (2014:9), *An investigative study into the perceived factors precluding auditors from using CAATs and CA,* the lack of infrastructure was cited as the main reason for not implementing CAATs, or more specifically GAS. Other important factors mentioned for not implementing GAS were the cost implications associated with the purchase of commercially available software packages and the cost of employing auditors knowledgeable in the use of GAS.

The survey conducted by Protiviti (2015b:8) into the *Changing trends in internal audit and advanced analytics,* identified the following specific issues as posing the greatest challenges to internal audit functions' efforts to access data, successfully implement GAS and perform data analysis:

- location of the data (i.e., identifying in which system the source or master data resides);
- system constraints;
- confidentiality and privacy concerns related to the data being accessed;
- incompleteness of the data; and
- the ability to combine data from multiple systems or environments for analysis purposes.

The study by the IIA (2016o:10) entitled *Data Analytics: Elevating Internal Audit's Value,* identified the following major challenges to internal audit functions' efforts to incorporate data analytics into their audits:

- difficulty in obtaining, accessing and/or compiling the data;
- time required to develop and execute analytical procedures;
- insufficient existing resources and/or the need to train personnel;
- lack of understanding of data analytics;
- lack of management buy-in; and

- inability to interpret the results obtained.

With reference to the studies and research reports cited it is evident that the issues of access, availability, accuracy, completeness and integrity of the data are consistently identified as a top concern in a majority of these studies, and that these issues adversely impact on the internal audit functions' decision to integrate the use of GAS and data analytics into their respective audit methodologies. In addition, the IAASB (2015 ISA 500 par.A26) points out that the quality of **all** audit evidence gathered (as mentioned in section 3.2) during the conduct of an audit is dependent on its **reliability** and **relevance** on which is based. Simply put, data analysis results that are based on incomplete, inaccurate or invalid data might lead to engagement objectives not being achieved, and more importantly, might lead to unreliable audit opinions being expressed regarding the effectiveness and soundness of an entity's operations (whether a bank or another commercial organisation). It is therefore not surprising that the issues of access, availability, accuracy, completeness and integrity of data have been identified as a top concern in a majority of the studies and research reports cited.

While the factors and limitations highlighted by internal audit functions earlier are regarded as valid concerns and justifications not to fully implement GAS, they should not however totally discourage the use and adoption thereof, and deny the internal audit function the benefits of the related data analysis capabilities. With the implementation of formalised quality assurance review procedures within the internal audit function the validity of the work performed and its alignment with the overall audit objective can be easily verified. Such practice should render reliable and persuasive audit results regardless of methodology and tools employed, thus effectively negating the "fear of failure" justification for not adopting GAS. In the words of John Holt (cited in Ridgers, 2012:187), *"If you're not making mistakes, you're not taking risks, and that means **you're not going anywhere*** [own emphasis]. *The key is to make mistakes faster than the competition, so you have more chances to learn and win."* These words are equally true for those internal audit functions that are not willing or reluctant to embrace the power of data analytics brought about by GAS. To reiterate the statement made by Zitting (2016:2) introduced in section 3.1, internal audit functions that are still fixated on executing their engagements based on traditional techniques will soon run the risk of becoming obsolete (i.e., they are not going anywhere). On the other hand, those internal audit functions that do embrace the use of GAS and data analytics should be able to produce audit results that deliver valuable insights to their stakeholders, and in an efficient manner. A key benefit or goal to be realised by these internal audit functions through adoption and implementation of GAS is to reach a more advanced level of maturity where routine analytics that are embedded in the client's systems allow for continuous testing of controls (ACL, 2013:14; Deloitte, 2013:5; PwC, 2013b:2; IIA, 2016o:40).

3.6 A BRIEF OVERVIEW OF CONTINUOUS AUDITING AND ITS RELATION TO INTERNAL AUDIT

The internal audit functions of today are confronted by many and increasingly complex challenges. These have put them under even greater pressure as they are still required to deliver on their assurance mandates (refer to section 2.2.2). To reiterate, some of these pressures, amongst others, experienced by internal audit functions (also refer to section 2.2.5) are:

- they are expected to do more with less (i.e., they must perform "lean" audits as a result of cost cutting and pressure on organisations' audit budgets);
- they are required to provide the audit committee, senior management and other stakeholders with timely audit results that demonstrate deeper insight and offer enhanced value;
- they are expected to provide assurance on a much broader organisational risk and control landscape;
- they are required to play a more prominent role with regard to compliance and risk management;
- they are viewed as trusted advisors of senior management and are expected to fulfil a more proactive role regarding the identification of risks and controls; and
- they need to conduct their day-to-day activities in a control environment that is dominated by technology and big data (Baker, 2009b:30; KPMG, 2013:2; IIA, 2014:1; Malaescu & Sutton, 2015:96; Protiviti, 2015b:9; PwC, 2015:17; Tusek, 2015:188).

The mentioned pressures necessitate that internal audit functions continue to evolve, moving from just performing basic data analytics with the use of GAS (i.e., the early stages of maturity when data analysis techniques are first adopted, as was discussed in section 3.5.1) through increasingly advanced levels of analytic sophistication until they are performing data analytics on a continuous basis (i.e., until continuous auditing is standard practice). This evolvement towards continuous auditing capability is a discernible but slow trend. This can be seen in the increase of 7% in its use over the 10 year period since CBOK 2006, as was reported in the IIA's Research Foundation's (2015a:5) 2015 CBOK report: *Staying a step ahead: Internal audit's use of technology* (also refer to section 2.2.5). It should be noted that although the increase is noticeable, it has been measured off a very low starting level (currently at 44%). Thus, the absolute number of internal audit functions that have achieved this advanced level of maturity in the use of data analytics is still relatively small.

The term continuous audit is often confused with the term continuous monitoring. The following definitions are provided next in order to clearly distinguish between these two closely related terms.

3.6.1 Continuous auditing

This refers to the repeated automated collection of audit evidence and indicators by an internal auditor making use of information technology systems, processes, transactions and controls at regular intervals. It includes the performance of analytical procedures on a predefined schedule (e.g., weekly, monthly or quarterly) and is based on the identification of specific criteria as defined by the auditor (ACL, 2013:11; KPMG, 2013:2; IIA, 2015j:1; IIA, 2016o:44).

3.6.2 Continuous monitoring

This term refers to the feedback mechanism for ongoing management review in order to verify whether implemented controls are functioning as intended and whether transactions are being processed according to the predefined criteria. Continuous monitoring is a management responsibility and therefore forms an integral part of an organisation's internal control environment (ACL, 2013:14; KPMG, 2013:2; IIA, 2015j:1; IIA, 2016o:45).

Although these two terms are closely related the main difference lies in the roles and responsibilities associated with the key role-players in each process. Reviewing the definitions provided it should be clear that continuous auditing is a responsibility that resides with the internal audit function, whereas continuous monitoring is a management responsibility. Internal audit functions that have already achieved or that are aiming to reach a level of maturity where continuous auditing is conducted within their departments can potentially experience the following benefits:

- optimisation of the balance between the review efforts of internal audit and management;
- a more efficient use of organisational resources;
- reduced cost of assessing and providing assurance over the adequacy of internal controls;
- the ability to provide an ongoing evaluation of risks and controls;
- the ability to provide timely reporting of gaps and weaknesses, thus enhancing the opportunity for prompt corrective action by management;
- flexibility in order to prioritise corrective action to be taken by management;
- an enhanced understanding of business performance, risks, and compliance; and
- the ability to provide continuous assurance regarding controls, risks, and opportunities (ACL, 2013:11; IIA, 2015j:2).

In order for internal audit functions to realise the benefits brought about by the implementation of continuous auditing (as discussed earlier) a clear understanding of the roles and responsibilities is needed so as to optimise the performance and coordination of continuous auditing and continuous monitoring efforts (refer to section 2.6 for a discussion on these roles and responsibilities according to the IIA's three lines of defence model).

Table 3.5 is taken from a section of the IIA's (2015j:3) Global Technology Audit Guide (GTAG 3) entitled *Continuous Auditing: Coordinating Continuous Auditing and*

Monitoring to Provide Continuous Assurance. It provides a clear picture of the allocation of the roles and responsibilities between the various levels of management and the internal audit function, within the context of the three lines of defence model.

Table 3.5: Continuous assurance roles and responsibilities

ROLE	RESPONSIBILITIES
CAE	• Establish credibility for continuous auditing activities by ensuring the capability of internal auditors and the sufficiency of their tools, data security arrangements, and budget; • Educate internal auditors, senior management, and the board on the roles and responsibilities of the internal audit activity and management; • Commit to a multi-year strategy to grow support from stakeholders; and • Communicate results of internal audit's assessment of the effectiveness of continuous monitoring.
Internal Audit (Third line of defence)	• Plan continuous auditing jointly with first and second lines of defence; • Perform continuous auditing: o Relate analytics to assertions and business objectives o Align risk factors and control activities o Add value as a trusted adviser by assessing emerging enterprise risks • Perform audit testing of continuous monitoring; • Provide continuous assurance in connection with audit objectives such as completeness, accuracy, and security; • Maintain effective data security arrangements.
Management (First and second lines	• Design and perform continuous monitoring to assess the adequacy and effectiveness of risk management

ROLE	RESPONSIBILITIES
of defence)	and control; • Draw on process expertise and act on risk. Develop and implement management resolutions that address root causes; • Shorten the time to management action.

(Source: IIA, 2015j:3)

Reviewing the information in Table 3.5 it is clear that the responsibility for continuous auditing rests with the internal audit function, while continuous monitoring is the main responsibility of management. Although continuous monitoring is the responsibility of management, it can also enable the internal audit function to guide and prompt management action on areas of weakness that fall within their span of control (ACL, 2013:14). It is also apparent that the CAE plays a crucial role, coordinating and promoting the necessity for implementing continuous auditing, as the technology-based tool enables the internal audit function to deliver on its mandate more efficiently and effectively, and thus to satisfy the demands of its various stakeholders. The IIA (2016o:46) also points out that unless a specific "someone" in the organisation (with the necessary authority and incentive) promotes the use and benefits of employing data analytics, efforts to implement it are likely to fail. Conversely, those internal audit functions that successfully allocate and implement the roles and responsibilities outlined in Table 3.5 with regard to continuous auditing, should experience additional benefits. These benefits arise as their data analytics efforts are more mature than those practiced in functions that are in the early stages of adopting data analysis techniques (IIA, 2016o:44). One such added advantage of a mature data analytics capability, is that the internal audit function's successful implementation of continuous auditing may lead to an increased reliance on the internal audit function's work by the external auditor (refer to section 2.4.2 for a discussion on the relationship between external audit and internal audit). The results from the study conducted by Malaescu and Sutton (2015:107) (entitled: *The reliance of external auditors on internal audit's use of continuous audit*), confirm that external auditors tend to place increased reliance on the work of internal audit when the internal audit function makes use of continuous auditing. It should be borne in mind that there are different levels of maturity displayed by internal audit functions in their adoption and utilisation of data analytics (also refer to sections 3.5.1 and 3.5.2). The next section therefore provides an overview of various data analytics maturity frameworks specifically related to the use of data analytics by internal audit functions.

3.7 DATA ANALYTICS MATURITY FRAMEWORKS FOR INTERNAL AUDIT FUNCTIONS

Data analytics enable internal auditors to provide “hindsight, insight and foresight”. All three of these together can be referred to as the internal audit function’s “line of sight” (ACL, 2013:3). This “line of sight” enables internal auditors to provide meaningful feedback to their various stakeholders from three perspectives, namely; historical (hindsight), current (insight into the current control environment) and future (foresight) (IIA, 2011:6; ACL, 2013:3; Deloitte, 2013:3; KPMG, 2013:2; PwC, 2013b:4; Coderre, 2015:39; Deloitte, 2016c:2). To put it differently, the primary or basic forms of data analytics are focused on answering questions such as: “what happened?” or “why did it happen?” In other words, it is focused on providing feedback from historical and at best, current perspectives. These types of analytics are known as **descriptive** and **diagnostic** analytics (Deloitte, 2013:3; IIA, 2016o:14). They are useful to improve the efficiency of organisational processes and can also inform strategic decisions. On the other hand, more advanced analytics can be used to answer questions such as: “what might happen?” or, “what is the best/worst that could happen?” These types of analytics are known as **predictive** and **prescriptive** analytics, which provide a view of potential situations that could require future action, such as updating the state of the control environment to address a potential materialising risk (IIA, 2016o:14). From an internal audit perspective, the predictive capability of analytics is paving the way for internal audit functions to conduct risk-focused annual audit planning, and also to focus audit efforts on high risk areas that warrant emphasis (Deloitte, 2013:3).

In order to advance from simply providing basic descriptive and diagnostic data analytics to more complex data analytics (where predictive and prescriptive analytics are performed) requires an internal audit function to evolve through the different levels of maturity on the data analytics maturity continuum. It should be obvious that, as with all new techniques and technologies, there are different levels of maturity in the adoption and use of data analytics by internal audit functions. A review of internal audit literature revealed various data analytics maturity frameworks, and these formed the basis for the development of the research instrument used in this study. (The development of the research instrument was discussed in chapter 1). The data analytics maturity frameworks were identified from the following authoritative internal auditing literature:

- *The ACL audit analytic capability "maturity" model* (ACL, 2013:4);
- *Adding insight to audit – Transforming internal audit through data analytics* (Deloitte, 2013:5);
- *Harnessing the power of data – How internal audit can embed data analytics and drive more value* (EY, 2014:4);
- *The Internal audit analytics conundrum – finding your path through data* (PwC, 2013b:2);
- *Data analytics for internal audit* (KPMG, 2013:5);
- *Data Analytics: Elevating Internal Audit's Value* (IIA, 2016o:40) and
- *Global Technology Audit Guide (GTAG) 16 Data Analysis Technologies* (IIA, 2011:21).

Goksen, Cevik and Huseyin (2015:209) state that: *"Maturity models are based on the premises that people, organizations, functional areas, processes, etc., evolve through a process of development or growth in the direction of a more advanced maturity,* ***going through a distinct number of levels*** [own emphasis]*"*. In addition, Tarhan, Turetken and Reijers (2016:122) describe a maturity model as: *"… a conceptual model that consists of a sequence of* ***discrete maturity levels*** [own emphasis] *for a class of processes in one or more business domains, and represents an anticipated, desired, or typical evolutionary path for these processes"*. Reviewing these descriptions it is clear that a maturity model or framework consists of specific levels, each with unique characteristics. Thus, it is indicative that a form of growth or evolvement has to take place in order to advance to a more "mature" level. Each of the data analytics maturity frameworks mentioned proposes a different set of levels of maturity and identifies the characteristics associated with each level of maturity when employing data analytics. These data analytics frameworks are individually illustrated:

Table 3.6: The ACL audit analytic capability "maturity" model

LEVELS				
Basic (Level 1)	**Applied (Level 2)**	**Managed (Level 3)**	**Automated (Level 4)**	**Monitoring (Level 5)**
• The use of data analytics is typically ad hoc and undertaken by auditors who have received introductory training. • There is usually little involvement from management. • Often an auditor with technical interests selects the analytic software, which is then used	• People and process issues are important at this level. • Audit management needs to provide direction and support, and a specialist is often assigned the role of data analyst to oversee the development of analytic projects and procedures.	• Involves the development of many analytic tests that process large volumes of different data sets and generate results that often involve confidential information. • In most cases, many people are involved in this process and information is spread across various computers	• The Automated level builds upon the previous levels as the foundation for continuous auditing and monitoring. • Comprehensive suites of tests have been developed, tested and are available in a central, controlled environment. • Data access for analysis and tests is	• Regular repeated (continuous) testing of transactions and controls is provided directly to management for response. • Continuous monitoring takes place at this level. • The main characteristic difference between Level 4 (continuous auditing) and Level

LEVELS				
Basic (Level 1)	**Applied (Level 2)**	**Managed (Level 3)**	**Automated (Level 4)**	**Monitoring (Level 5)**
by that individual or only a limited number of specialists within the broader audit team.	• Review and quality assurance procedures are put in place to confirm the quality and validity of audit analytics that are performed. • The use of analytics is progressive within this level. • After starting with "low-hanging fruit," usage grows over time as additional tests are added to	in multiple and often geographically diverse locations. • A well-structured and centrally-managed server environment is established to store and maintain the large data sets and content of the audit analytics processes (e.g., tests, results, audit procedure documentation and related materials).	secure but easily accessible by stakeholders. • All that remains from a technology perspective is to schedule tests to run regularly against appropriate period data. • A significant shift in audit process is required. • Commencements of continuous auditing	5 (continuous monitoring) are the workflow processes by which the business area is notified of exceptions and responds to them, as well as the use of dashboards for overall reporting of continuous monitoring results, status and trends. • The results of widespread testing can be accumulated

LEVELS				
Basic (Level 1)	**Applied (Level 2)**	**Managed (Level 3)**	**Automated (Level 4)**	**Monitoring (Level 5)**
	support a broader set of audit objectives. • Consideration is given to how analytics can best be applied on every new audit. • Additionally, training becomes in-depth and technical, with a focus on data access and integration and efficient script design for	• Complex processing of large data volumes is typically performed on high-powered servers. • Access to and use of content is subject to planned processes and is controlled and secure. • Procedures, standards and documentation for audit analytics are even more formal	in one area and then expansion to additional areas over time as appropriate procedures are established.	and reported to show trends of risk areas and changing risks where, for example, a pattern of an increasing number of a certain type of exceptions becomes obvious.

LEVELS				
Basic (Level 1)	**Applied (Level 2)**	**Managed (Level 3)**	**Automated (Level 4)**	**Monitoring (Level 5)**
	repeatability. • For the audit manager, training in how to effectively oversee and leverage the audit analytic process becomes invaluable for integrating the benefits of analytics throughout the audit function.	than at the Applied level. • Most significantly, at this level it is more practical and common for non-technical auditors to efficiently access and use the results of tests.		

(Source: adapted from: ACL, 2013:4)

Table 3.7: Deloitte's maturity model for internal audit analytics

LEVELS				
Initial (Level 1)	**Developing (Level 2)**	**Defined (Level 3)**	**Advanced (Level 4)**	**Leading (Level 5)**
• No or limited capabilities. • Ad-hoc activities resulting in unpredictable performance. • Success is based on individual competence and not on repeatable processes.	• The organisation exhibits a basic set of capabilities. • Processes are rudimentary and loosely interwoven. • Success is repeatable with similar application and scope, but not consistent across organisation.	• Capabilities are developed and adopted consistently. • Capabilities are used to drive some audit activities. • Management defines goals and objectives for standardised processes and confirms they are communicated.	• Capabilities are well-developed and practiced with appropriate governance. • Processes are used to drive audit activities. • Processes and practices are routinely analysed for effectiveness and efficiency.	• Capabilities are well-defined and institutionalized. • The department has differentiated itself based on its capabilities. • Continuous improvement methodologies are used to adapt to future changes.

(Source: adapted from Deloitte, 2013:5)

Table 3.8: EY's internal audit analytics maturity model

LEVELS				
Initial (Level 1)	**Repeatable (Level 2)**	**Defined (Level 3)**	**Managed (Level 4)**	**Optimised (Level 5)**
• No formal analytics approach, procedures or methodology. • Performed occasionally at best. • Tools are not readily available. • Dependent on skills of limited number of subject matter resources.	• Recognised as a value-add to audit. • Not yet institutionalised. • Relies on a central group or single person. • Tools are available, but not applied consistently or correctly.	• Enforced analytics policy. • Established analytics methodology. • Use of analytics championed by internal audit management. • Quality of analytics results are evaluated.	• Methodology is institutionalised. • Management involved in ongoing analytics efforts. • Management understands business issues and root causes. • Re-performance of analytics procedures. • Advanced tools are	• Practices evolved in the first four phases are used to continually improve analytics processes, procedures and results. • Continuous control monitoring tools.

LEVELS				
Initial (Level 1)	**Repeatable (Level 2)**	**Defined (Level 3)**	**Managed (Level 4)**	**Optimised (Level 5)**
		• Understanding of the business meaning of analytics procedures and results.	used.	

(Source: adapted from EY, 2014:4)

Table 3.9: PwC's data analytics maturity scale

LEVELS					
Initial (Level 0)	**Relevant (Level 1)**	**Consistent (Level 2)**	**Integrated (Level 3)**	**Embedded (Level 4)**	**Transformational (Level 5)**
• Capability limited to very few individuals. • Inconsistent effectiveness. • Limited audit or business value.	• Limited but growing capabilities. • Ad hoc activities resulting in unpredictable and inefficient performance. • Success based on individual competence.	• Capabilities developed and adopted. • Capabilities used to drive audits. • Defined goals and standardised processes and tools emerge.	• Capabilities are well developed and practiced with appropriate governance. • Data sources are readily available. • Activities begin to become repeatable and CM metrics are developed.	• Scale is achieved for department-specific teams. • Improvement methodologies are implemented. • Monitoring occurring for metrics and controls.	• Analytics risk models being adopted by the business. • Analytics changing auditor behaviours. • New value propositions. • Alignment and cross-leverageable platform across

LEVELS					
Initial (Level 0)	**Relevant (Level 1)**	**Consistent (Level 2)**	**Integrated (Level 3)**	**Embedded (Level 4)**	**Transformational (Level 5)**
			• Core analytics skillsets within 5-10% of department.		lines of defence. • Game changing (i.e. transforming the internal audit function) to audit delivery and value.

(Source: adapted from PwC, 2013b:2)

Table 3.10: KPMG's data analytics maturity assessment

LESS MATURE STATE		MORE MATURE STATE	
Level 1	**Level 2**	**Level 3**	**Level 4**
Macro-level analytics for risk - or performance focused process assessments: • Broadly focused, not a very deep dive. • Used for high-level audits or for high-level risk assessments for audit determination.	Macro- and micro-level analytics for special audit projects: • Narrowly focused on an area or issue and can include a deep dive.	Macro- and sustained micro-level analytics for quantitative-based risk assessment for audit planning purposes: • Repeatable and sustainable, continuous risk assessment process for dynamic audit planning purposes and moving toward CA enablement.	Macro- and sustained micro-level analytics for controls testing and/or compliance auditing: • Optimised in a repeatable and sustainable process maturing to a CA/CM process.

(Source: adapted from KPMG, 2013:5)

Table 3.11: IIA's data analytics maturity model framework

LEVELS				
Ad Hoc (Level 1)	**Defined (Level 2)**	**Repeatable (Level 3)**	**Institutionalised (Level 4)**	**Optimised (Level 5)**
• Dedicated internal audit function with limited data analytics skillset. • Small sample sizes. • Inconsistent reporting. • Heavy reliance on IT to obtain data. • Process does not leverage prior audits and lessons learned.	• Capability to "borrow" data analytics expertise from other departments. • Use cases understood and prioritized by staff. • Data governance framework established and understood. • Large sample sizes.	• Dedicated data analytics staff in internal audit with advanced capabilities (e.g., CAATs). • Established success metrics around desired skills. • Continual training requirements specific to data analytics.	• Dedicated data scientist within internal audit. • Developed strategy for additional capabilities. • Road map for implementation across enterprise. • Direct link from activity to risk mitigation understood and applied.	• Dedicated data scientist within internal audit and significant number of other internal auditors with data analytics skills. • Risk coverage, profiles, and other constraints captured and used to optimize scheduling. • Compensation connected to data analytics skillset.

LEVELS				
Ad Hoc (Level 1)	**Defined (Level 2)**	**Repeatable (Level 3)**	**Institutionalised (Level 4)**	**Optimised (Level 5)**
• Spreadsheets.	• Consistent reporting. • Established data access protocol with IT. • Process leverages historical lessons learned on a limited basis. • Other reporting and relational databases. • Data visualization tools (limited basis).	• Significant sample sizes. • Standard reporting. • Data verification and accuracy protocol established. • Process applies a standardized approach that incorporates historical lessons learned. • Data access on demand.	• Performance metrics include data analytics. • Significant or all data audited. • Continuous auditing throughout internal audit function. • Reporting shared across stakeholders. • Root-cause understanding of exceptions.	• Real-time data monitoring with alerts. • Continuous monitoring throughout business function. • Real-time reporting accessed through self-service business intelligence. • Closed-loop process to measure success and value.

LEVELS				
Ad Hoc (Level 1)	**Defined (Level 2)**	**Repeatable (Level 3)**	**Institutionalised (Level 4)**	**Optimised (Level 5)**
		• Data interrogation scripts are defined. • Workflow and data capture technology. • Data visualization tools used for reporting.	• Process is continually enhanced based on lessons learned. • Access to central enterprise data store. • Automated scripting and testing. • Data visualisation tools integrated for data input, analytics, and reporting.	• Process to change root causes to alter outcomes. • Automated data extraction, transfer, and load (ETL). • Advanced analytics available for use within function. • System information management (SIM) software.

(Source: adapted from IIA, 2016o:40)

Table 3.12: IIA's data analysis usage maturity levels

LEVELS				
Print/Paper-based (Level 1)	**Reliant primarily on spreadsheets (Level 2)**	**Isolated and occasional (Level 3)**	**Integrated (Level 4)**	**Fully optimised (Level 5)**
• Auditors spot-check printed copies of documentation seeking evidence of controls compliance. • Relying on the work of others. Development of data analysis skills are in its infancy, in the planning stages at best.	• Audit processes make use of spreadsheets for light analysis (sorting, calculating, control totals, sums, etc.), sampling of small data sets, limited use of macros to locate anomalies in subpopulations of data. • Starting to recognize the need for	• The audit department has some individual or single resources versed in the use of data analysis software. Often times the role of data analysis has been centralized to one individual. Application of data analysis in audit programs is sporadic and unformulated.	• Data analysis is used in every applicable audit engagement, and in each stage of the audit cycle from risk assessment, planning, preparation, testing, issue follow-up, and reporting. • Proficiency in data analysis technology is a job requirement for some or all of the	• Data analysis is engrained in all audit programs. The audit department relies heavily on data analysis technology during all stages of the audit plan. Many audit processes are automated to ensure the quality and consistency of results. Data analysis technology is acknowledged as

LEVELS				
Print/Paper-based (Level 1)	**Reliant primarily on spreadsheets (Level 2)**	**Isolated and occasional (Level 3)**	**Integrated (Level 4)**	**Fully optimised (Level 5)**
	independent verification and objectivity. Starting to become aware of the possibilities. Generalised software tools employed with known limitations.	Challenges exist in acquiring data from IT. • Some false starts and activities not necessarily sustainable for a long period. Acquire professional data analysis tools without the opportunity to fully implement. Realize that “peer” groups may be making significant strides.	audit staff, depending on its size and make-up. • Close integration exists with IT and the rest of the organisation regarding access to pertinent data and dissemination of results. • Top-down support to meet functional strategic directives is in place. It is	an essential component in enabling the audit function to complete their audit plans. • Companywide recognition and support for data analysis as a core competency of the internal audit function to support the expected assurance and consulting services.

LEVELS				
Print/Paper-based (Level 1)	**Reliant primarily on spreadsheets (Level 2)**	**Isolated and occasional (Level 3)**	**Integrated (Level 4)**	**Fully optimised (Level 5)**
		Push for data analysis skills more bottom-up driven.	recognized that data analysis can assist internal audit in providing heightened levels of assurance by looking for unauthorized, incomplete, or inaccurate data or seeking indicators in the data that can lead to recommendations to improve the organization's overall performance.	

(Source: adapted from IIA, 2011:21)

Reviewing all of the data analytics maturity frameworks it is evident that each level of maturity has its own unique characteristics. To advance from one level to the next requires an internal audit function to illustrate growth or improvement with regard to their current capabilities in the use of data analytics for tests of controls purposes. It is also noticeable that functions demonstrating the most basic level of implementation (depicted as level 0 and/or level 1), only make limited use of data analytics and perform basic data analytics procedures: in other words, they only manage to provide **descriptive** and **diagnostic** analytics. Accordingly, with reference to the internal audit function's "line of sight" as mentioned, the internal audit contribution at this basic or introductory level is limited to providing "hindsight", but may also start to provide "insight" regarding the state of the control environment. By way of contrast, internal audit functions that have transitioned to a more mature state and are illustrating capabilities to perform at levels 4 and 5, have reached the levels where continuous auditing and continuous monitoring can be performed (also refer to section 3.6 for a brief discussion on continuous auditing and continuous monitoring). In other words, these functions have advanced to levels where they can provide **predictive** and **prescriptive** analytics. The internal audit contribution at these levels is of "insight", and predominantly "foresight", regarding the state of the control environment.

It should however be borne in mind that the successful employment of data analytics is not only reliant on the **technological** aspect (such as the specific audit software tool used to perform analytics). Equally important to ensuring the success of a data analytics initiative are the aspects of managing the **people** and the **processes** (ACL, 2013:6; Deloitte, 2013:5; KPMG, 2013:11; PwC, 2013b:7; Coderre, 2015:40; IIA, 2016o:49). In other words, in assessing levels of maturity it could happen that a specific internal audit function is on a higher level of maturity with regard to the technology it has at its disposal than it is on when assessing the level of maturity of the people aspect (i.e., do we have the necessary skills available to ensure the data analytics initiative will be successful?). It is therefore important that these three components (people, process and technology) be assessed in conjunction in order to provide an overall assessment of the level of maturity displayed in the use of data analytics by an internal audit function. Such an approach to measuring the level of maturity could provide CAEs with valuable information with regard to identifying the specific areas in need of improvement (people, processes and/or technology) which is prerequisite to advancing the entire internal audit function to the next level of maturity (IIA, 2016o:41).

Improving the **people** aspect requires considering matters such as: the training requirements of the internal audit staff on the use of GAS and conducting data analytics; whether each internal auditor within the internal audit function should have the knowledge or competency to perform data analytics, or should it be limited to a select few individuals; and whether a separate, specialist, dedicated data analytics group should be formed within the internal audit function (Coderre, 2015:40; IIA, 2016o:49).

The aspect of **processes** refers to the fact that data analytics should be integrated into all phases of the engagement (also refer to section 2.2.3). In this regard the CAE has a critical role to play, most importantly to establish goals and intermediate milestones regarding the implementation of data analytics, and to promote its use to the entire internal audit function. Thus, the CAE has to ensure that everyone understands how it will be integrated, from the annual planning phase all the way through to the audit reporting phase (also refer to Table 3.5 for the CAE's responsibilities regarding data analytics) (PwC, 2013b:7; Coderre, 2015:41; IIA, 2015j:3; Protiviti, 2015b:8). Internal audit functions that are serious about actively pursuing a transition from traditional audit approaches and techniques to one that fully utilises data analytics in its most advanced form must realise it will take time. Zitting (2016:3) puts it this way: *"Start small and evolve, but actually start"*.

The various data analytics maturity frameworks discussed in this section have been further analysed in order to identify "universal" benchmark criteria (as discussed in section 1.1) applicable at each level of maturity. The data analytics maturity framework used in this study is essentially a composite of those discussed in this chapter, and is included as Annexure B. The common characteristics identified were collated and presented in Chapter 1 as they informed the preparation of the research instrument used in this study. Section 1.4 of Chapter 1 provided a discussion on the development of the research instrument used in this study. The questionnaire used in this study is included as Annexure C.

3.8 CONCLUSION

In this chapter a discussion of the technology-based tools employed by internal audit functions, and more specifically the use of CAATs and GAS, was undertaken. The importance of the adoption of technology-based tools by internal audit functions cannot be over-emphasised, especially today, where organisations (and specifically banks) are placing ever-increasing reliance on computers to process business transactions. The notion of "big data" brought about by this increased use of technology was also highlighted. The advent of big data has not only had an impact on the manner in which organisations and banks manage the day-to-day running of their business transactions, but also on the internal audit function. To reiterate: two important internal audit aspects most significantly affected in this regard are big data's impact on the nature of audit evidence (as was discussed in section 3.2), and secondly on the methods or techniques necessarily employed to obtain sufficient, reliable, relevant, and useful audit evidence to support the achievement of engagement objectives and related audit results. In addition, section 3.1 made specific reference to the obsolescence risk that internal audit functions may face if they believe they can continue to deliver on their mandate using traditional methods and techniques, such as the conduct of interviews, the completion of questionnaires and by testing controls on a sample basis.

The internal audit functions of today are under enormous pressure to maximise efficiency and to continue to deliver value to their diverse set of stakeholders on an enlarged organisational and general risk landscape, and to produce audit results that are of increased value and insight. Despite the increased pressure on the internal audit function, the advancements in technology and the arrival of the era of big data, it is nevertheless evident that internal audit functions are still reluctant to fully embrace the power of data analytics, despite this having been made possible (and increasingly accessible) with the application of GAS. To reiterate: two important and recent studies have confirmed the low usage levels of CAATs and specifically GAS (as mentioned in section 3.5). They are: the global results of the IIA's (2015a:6) 2015 (CBOK) report entitled *Staying a step ahead: Internal audit's use of technology,* and its report entitled *Regional Reflections: Africa* (IIA, 2016m:6). These reports indicate that 52% of the respondents do not use CAATs at all, or at best make only minimal use. Data specific to South Africa recorded that 57% of respondents' internal audit functions only utilise technology-based tools such as CAATs "to some extent" or else rely solely on manual interventions in the execution of their duties. There are however various reasons or factors that influence or justify the adoption and/or avoidance of the use of CAATs and GAS. These factors were discussed in sections 3.5.1 and 3.5.2 respectively. One of the main reasons advanced for not adopting GAS was the issue of access, availability, accuracy, completeness and integrity of the data. This justification for not adopting GAS was consistently identified as a top concern in a majority of the research studies mentioned in section 3.5.2.

However, there are some internal audit functions that do actively pursue the improvement of their current service offerings to their various stakeholders. These functions have adopted GAS and the automation of audit processes in conducting their internal audit work, although still only achieving a basic level of maturity. The different levels of maturity that are used to describe the conduct of data analytics were discussed in section 3.7. It was noticed that at a very basic level data analytics produces results that are descriptive and diagnostic in nature, whereas at more advanced levels of maturity predictive and prescriptive analytics are produced. With the growth in the resource known as big data, coupled with the growing levels of uncertainty in the global economic climate, specifically with reference to the banking industry, it is expected that the role of and reliance on the internal audit function will be as important as ever, with a firming expectation that the function will continue to deliver on its mandate in accordance with the Standards. It is further anticipated that there will be increased pressure on internal audit functions to transition from traditional audit techniques to the adoption and use of technology-based tools such as GAS. It is therefore inevitable that those internal audit functions that want to remain viable and able to consistently deliver value adding results will have to adopt presently available and increasingly innovative techniques to do so. In addition, it is important to note that the value of and insight to be derived from the data is not only dependent on the specific GAS that is used. Knowledgeable internal auditors with an analytical mind set, and willing to apply their professional judgment in designing the tests to be executed with the GAS, and to interpret the results, are still required to ensure meaningful information is extracted from the data.

The next chapter presents the findings of the empirical study described in section 1.4. The analysis of the data collected will also be presented.

CHAPTER 4
EMPIRICAL RESULTS AND ANALYSIS

4.1 INTRODUCTION

This chapter presents an analysis of the data that emerged from the empirical study described in section 1.4. The term *data analysis* can be defined as "*the process of bringing order, structure and meaning to the mass of collected data*" (De Vos, 2002:339). The data was analysed using SAS after having been captured, cleaned, re-coded and organized as described in section 4.3. The data collected for the purpose of this study (as mentioned in section 1.4.9), was predominantly analysed using descriptive statistics. Descriptive statistics describe what the data looks like, and compares the variables numerically through the generation of frequency tables and percentages: these are recorded in Annexure G. Some cross-tabulations were also applied in order to calculate the relationships between some of the variables. No statistically significant relationships or associations were discovered from having performed the cross-tabulations and calculated mean scores. In addition, no additional insight was obtained through the use of the cross-tabulations: they merely re-confirmed what had already been confirmed through the use of the descriptive statistics.

Annexure G presents the descriptive statistics for all categories of variables in the survey. These measure the respondents' perceptions with regard to the use of GAS by internal audit functions in the locally controlled South African banking industry; they provide the frequencies in each category and the percentage out of the total number of the questionnaires completed. It is important to note that the descriptive statistics are based on the total population (9 out of 10 banks). In cases where no answers were supplied, these were reflected (and coded) as 'unknown' in the descriptive statistics.

The survey results are discussed and graphically presented in section 4.4, and reflect the descriptive statistics recorded in Annexures G, H and I. In addition, the discussion of the survey results focuses on the main outcomes that were generated by each of the survey questions posed. Annexure H presents the descriptive statistics (number of responses, mean/average, standard deviation, median and range) for all the continuous variables or categorical variables that are ordinal of nature.

Where appropriate, the findings were also compared to relevant international studies on the use of GAS by internal audit functions: these had been identified during the literature review process.

4.2 RESPONSE RATE

The locally controlled banking population consists of 10 banks that are permitted to conduct the business of a bank in South Africa, as mentioned in section 1.4.6. All of them have locally based in-house internal audit functions. Questionnaires were therefore sent to all 10 CAEs. They were given two weeks to complete the questionnaire, with the initial deadline being given as 5 August 2016, and this was extended to 15 August 2016. One bank's CAE indicated that they are not going to participate in the study. Thus, the total number of questionnaires returned was 9, resulting in an overall response rate of 90% of the population.

4.3 CAPTURING, EDITING AND CODING OF THE DATA

The data was provided in questionnaire format and was captured twice into an Excel spread sheet. The two data sets were then compared. Where differences were noted between the two data sets, the captured data was verified and compared to the original questionnaire. The information was then amended in order to ensure the accuracy of the data. The actual responses were then imported into SAS, and recoding was done in order to provide comparison groups according to the objectives of the study. The coding of the data is presented in Annexure J.

4.4 SURVEY RESULTS

Chapter 3 provided a discussion of the technology-based tools available to and used by internal audit functions, with specific emphasis on the use of GAS, which is one of the most frequently used types of CAATs for tests of controls. The purpose of this study (as mentioned in section 1.2) was to explore the levels of maturity of the use of GAS by the in-house internal audit functions of the locally controlled banking industry. The survey results indicate that 7 banks' (77.8%) internal audit functions are making use of GAS for data analytics purposes to obtain audit evidence for conducting tests of controls. While the remaining two banks (22.2%) are not using GAS, they are making use of other CAATs tools in order to conduct data analytics for tests of controls purposes, as discussed in section 4.4.2. The results displayed are systematically categorised as follows:

- Section 4.4.1 presents the results of the personal information of respondents (the responses to questions in section 1 of the questionnaire were used in this section).
- Section 4.4.2 presents the number of internal audit functions that use GAS for tests of controls purposes (the responses to questions in section 2 of the questionnaire were used in this section).
- Section 4.4.3 presents the results indicating the ability of internal audit team members to embrace data analytics (i.e., the maturity measurement aspect of **people**) (the responses to questions in section 3 of the questionnaire were used in this section).
- Section 4.4.4 presents the results indicating which processes banks have in place that support and enable the use of GAS (i.e., the maturity measurement aspect of **process**) (the responses to questions in section 4 of the questionnaire were used in this section).
- Section 4.4.5 presents the results of the technology platform banks employ that enables the performance of data analytics (i.e., the maturity measurement aspect of **technology**) (the responses to questions in sections 2 and 5 of the questionnaire were used in this section).
- Section 4.4.6 presents the results indicating the overall degree of satisfaction with the current level to which GAS has been implemented (the responses to questions in section 6 of the questionnaire were used in this section).

In section 4.5 the assessment of the maturity of the use of GAS is discussed. Each level of maturity is assessed in terms of three important aspects (refer to sections 1.4.4.1 and 3.7), namely: people, process and technology. The results, as discussed in sections 4.4.3 – 4.4.6, were used to perform the maturity assessments of these internal audit functions with regard to their use of GAS for tests of controls purposes.

The final conclusions drawn from the survey responses were then validated and checked by a professional statistician to exclude any misleading interpretations.

4.4.1 Personal information of respondents

The results revealed that the heads of the locally controlled banks' internal audit functions are highly qualified. Among them are four chartered accountants (CA (SA)), one certified internal auditor (CIA) and four certified information systems auditors (CISA). Two respondents also indicated "Other": one specified that his/her professional credentials include "Internal Audit Technician" and "Professional Internal Auditor", and the other indicated "MSc Financial Engineering". The distribution for the respondents' professional credentials is displayed in Figure 4.1. In addition, the respondents as a group, have an average of 12 years of experience in internal auditing, and an average of 9 years of experience in the use of GAS for internal auditing purposes.

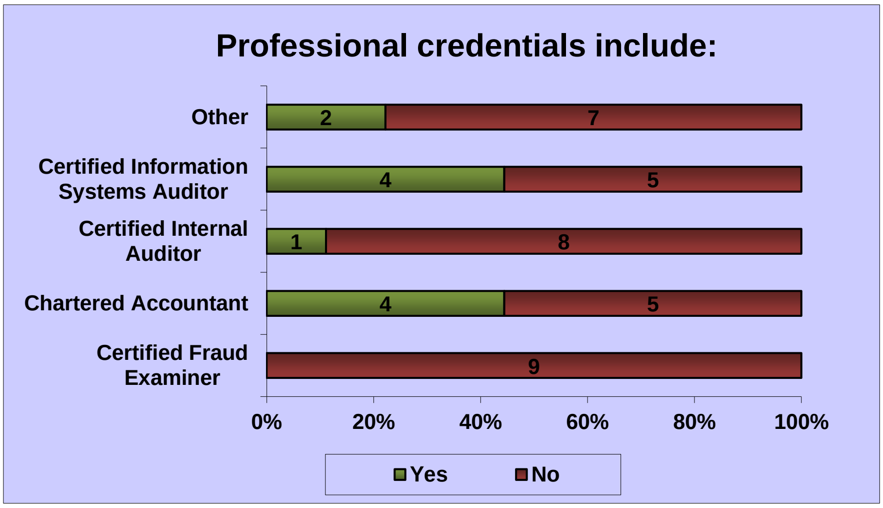


Figure 4.1: Professional credentials of the respondents

In addition, the majority of the respondents (five out of the nine respondents) consider themselves to be Internal Auditors; one respondent considers him/herself to be an IT Auditor, and another considers him/herself to be a Financial Auditor. Three of the respondents who selected “Other” specified; “Chief Internal Auditor”, “General Management” and “Head of Internal Audit”.

4.4.2 The use of GAS for tests of controls

As can be seen from Figure 4.2, the majority of respondents (seven out of the nine participating banks - 77.8%) currently use GAS for data analytics purposes in obtaining audit evidence for conducting tests of controls. Conversely, two out of the nine banks (banks 2 and 5) do not use GAS for data analytical purposes. It should be noted that although banks 2 and 5 do not currently use GAS they still completed the survey in the context of their intention/plans to implement GAS in the future.

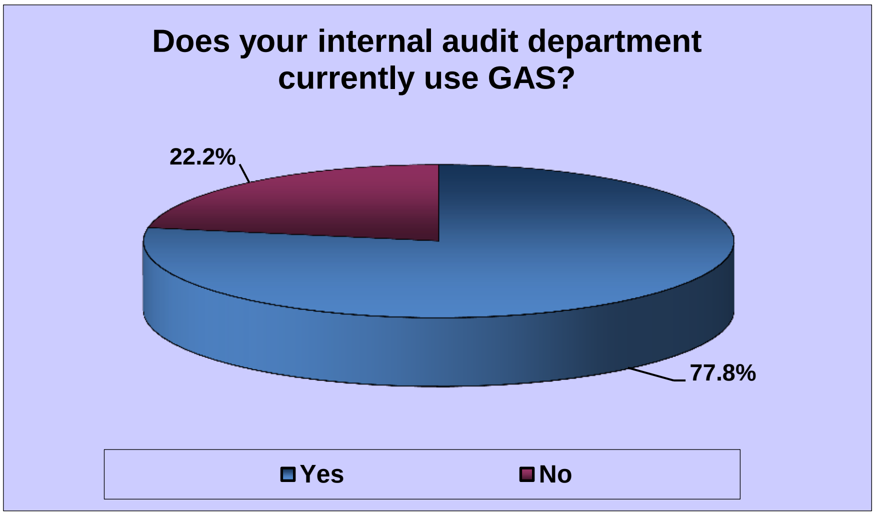


Figure 4.2: Use of GAS

In determining which GAS tool is the most popular (most widely used), it is apparent that ACL is currently the most popular GAS tool, and in use by 77.8% of the respondents as their preferred data analytics tool (refer to Figure 4.3). In addition, bank 5, although they do not currently utilise any GAS tool, indicated that they would like to implement ACL at a future date. The use of ACL was also identified as a popular GAS tool amongst internal auditors surveyed in the recently published research discussed in section 3.4.1. Nevertheless, there are also other CAATs tools available to conduct data analytics for tests of controls purposes (also refer to section 3.4.1). It should also be noted that determining the use of other CAATs tools did not form part of the scope of this study, as was mentioned in section 1.3. As indicated in

Figure 4.3 (as derived from the responses provided in question 2.2 of the questionnaire), there are three banks that indicated the use of other CAATs tools. Bank 3 indicated that they use SQL (another CAAT) in addition to their use of ACL. Similarly, bank 7 also indicated the use of ACL together with other CAATs namely, SAS and SQL. Bank 2 does not use any GAS package at present, but currently uses other CAATs tools, namely Microsoft Access and Microsoft Excel. It was further established that bank 5 also does not use any specific GAS tool to conduct data analytics, currently preferring to use Microsoft Excel exclusively. In addition, (banks 1 and 9) (as derived from the responses provided in question 5.6 of the questionnaire) indicated their use of ACL together with another CAATs tool, namely Microsoft Excel. The use of Microsoft Excel (i.e., spreadsheets) as a data analysis tool is usually associated with lower levels of maturity in the use of data analytics, as was discussed in section 3.7. This therefore adversely impacts on the assessment of the maturity of the technology aspect that is discussed in section 4.5.3.

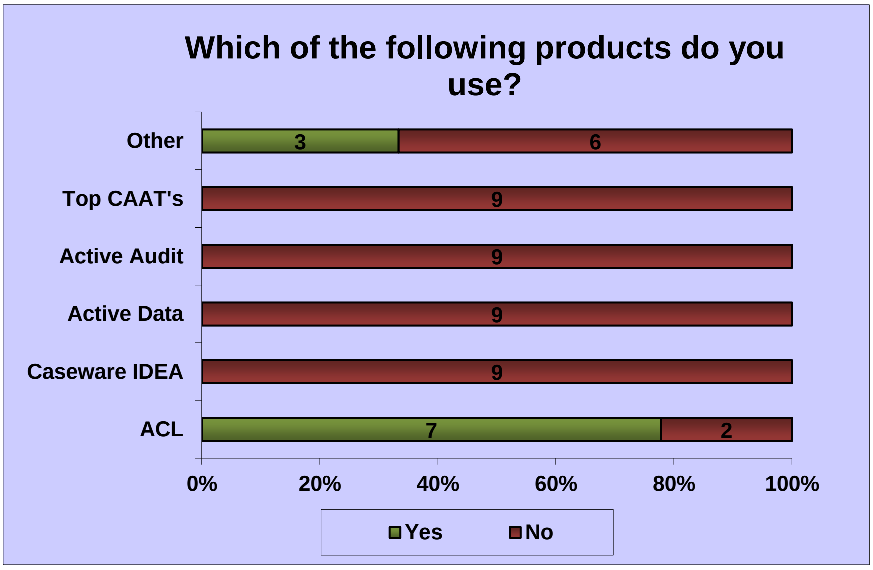


Figure 4.3: Products of GAS used

While 77.8% of the respondents indicated that they are currently ‘using GAS’, the results indicate that the frequency of its use (refer to Figure 4.4) in conducting internal audit engagements is still at a relatively low level. Three of the nine banks (33.3%) that use GAS (specifically ACL): (banks 1, 4 and 9) estimate that they use GAS in a maximum of 40% of the total number of engagements scheduled on their annual audit plans. Bank 6 estimate its use of GAS up to a maximum of 20% of the total number of engagements scheduled on their annual audit plan. Banks 2 and 5 are not using GAS; they however estimate they use other CAATs (i.e., Microsoft Excel and Microsoft Access) up to a maximum of 20% of the total number of engagements scheduled on their annual audit plans. Banks 7 and 8 use GAS more frequently, and estimate the use of GAS to be between 41% and 60% of the total number of engagements scheduled on their annual audit plans. Bank 3 is the exception/outlier, with an estimated frequency of use of GAS at between 81% and 100% of the total number of engagements scheduled on their annual audit plan.

With the increased pressures being experienced by internal audit functions (as mentioned in sections 2.2.5 and 3.6) to do more with less (i.e., to perform "lean" audits as a result of audit budget cost cuttings amongst other organisational cost saving efforts), and to provide assurance on a much broader risk and control organisational landscape, it was expected that the frequency of the use of GAS in conducting internal audit engagements would have been higher than this research has indicated. This is especially surprising as the banking industry's control environments are dominated by technology and big data. While this is the current situation, it is therefore not surprising to note that 88.9% of the respondents also indicated that they believe that GAS can be utilised more frequently than it is at present within their respective internal audit functions. The explanations offered for the perceived need for more frequent use of GAS are summarised in the following quotations:

- *"Currently, GAS is largely used by our "Data Analytics" team (for some years). In the last 6 months, we have commenced with implementing GAS across the team.*
- *From 1 April 2016 we have approval for an additional headcount, a data analyst, to join the team and drive our analytics strategy. At present, analytics is decentralised within our team.*
- *GAS should be part of as many audits as possible towards enhancing effectiveness and efficiency of our audit reviews.*
- *The use of GAS is dependent on the ability to timeously obtain data in the required format. GAS has been implemented in areas where the data is easily obtainable,*

however there is other areas for which there are hurdles in obtaining data timeously due to the safeguards in place to maintain the security of data.

- *We are currently using it on a limited basis. The audit environment could definitely benefit from more extensive use of the tools."*

These sentiments echo those presented by Smidt (2014:153) in his study on the use of sampling by internal audit functions in the South African banking industry. Smidt found that all of the respondents at that time also indicated that they believed that the future use of GAS packages (such as ACL and IDEA) would increase. This is an indication of an expectation that the volumes of data will continue to increase over time, and that audit functions will have to be innovative in their use of sophisticated techniques in order to remain relevant to their various stakeholders by continuing to provide reliable assurance. The respondents' estimates of their use of GAS on internal audit engagements are displayed in Figure 4.4.

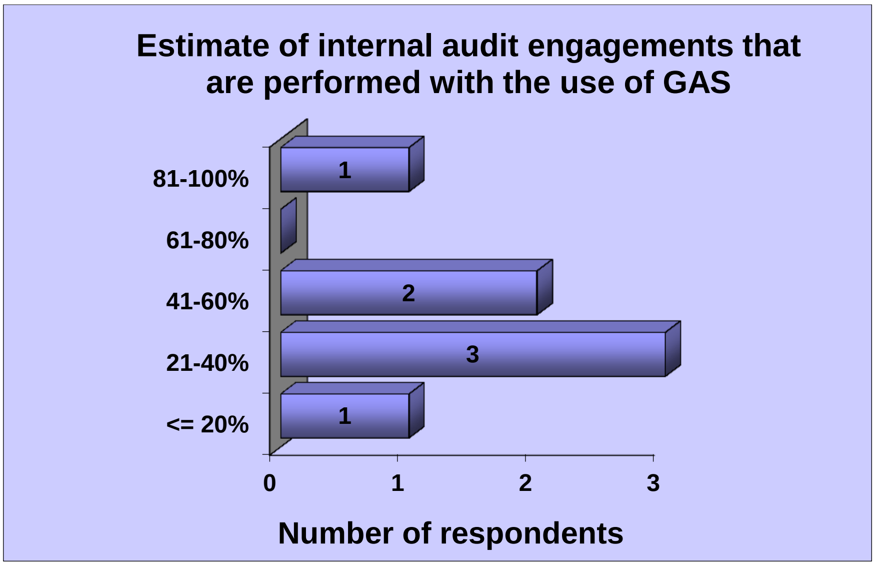


Figure 4.4: Estimate of internal audit engagements that are performed with the use of GAS

Although internal audit functions have the technology-based tools available (and specifically in this case the use of GAS (predominantly ACL as indicated) for performing data analytics for tests of controls purposes, the assessment of maturity of the use of GAS is not only dependant on the presence/availability of technology-enabled tools in these functions. Section 3.7 indicates that the three aspects of

people, **process** and **technology** should be assessed together to provide an overall assessment of the level of maturity displayed in the use of data analytics by internal audit functions. The following three sections provide an overview of each of these three aspects' contribution to determining the maturity of the use of GAS by internal audit functions. Section 4.4.3 provides an overview of the people aspect; section 4.4.4 highlights the processes that respondents currently have in place that support and enable the use of GAS within their internal audit functions. Section 4.4.5 is devoted to assessing the technology platforms the respondents' internal audit functions have in place that enables the performance of data analytics.

4.4.3 The ability of internal audit team members to embrace data analytics

As mentioned in section 3.7, the people aspect should consider matters such as, the training requirements of the internal audit staff in the use of GAS and conducting data analytics, whether each internal auditor within the internal audit function should have the knowledge or competency to perform data analytics (or should it be limited to a select few individuals), and should a separate and dedicated specialist data analytics group be formed within the internal audit function. The distribution of the individual internal auditors' capabilities in the use of GAS is displayed in Figure 4.5.

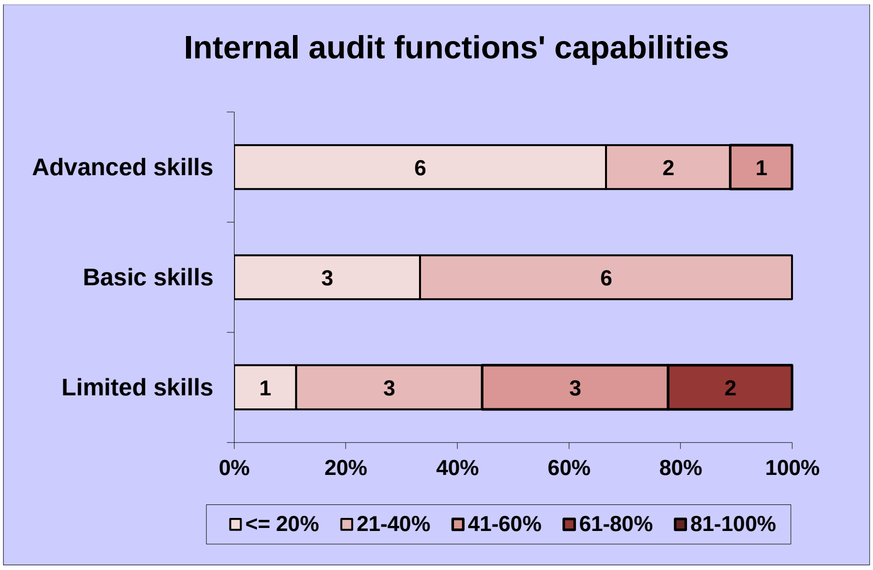


Figure 4.5: Internal audit functions' capabilities in the use of GAS

The following results refer to the capabilities of internal audit staff in using GAS (refer to Figure 4.5):

- For the purpose of this study, the term "limited skills" means that individual internal auditors only have an awareness of the commands or functions that GAS may offer, but they are not proficient enough to independently apply the basic functions and commands that are built into the GAS (for example: not able to run the duplicates, statistics, and summarise commands, or to draw random samples). The survey results show that 11.1% of the respondents (bank 7) indicated that at most, 20% of their internal audit staff has limited skills in the use of GAS; 33.3% of the respondents (banks 4, 6 and 8) indicated that between 21% and 40% of their internal audit staff has limited skills in the use of GAS; 33.3% of the respondents (banks 1, 2 and 3) indicated that between 41% and 60% of their internal audit staff has limited skills in the use of GAS, and 22.2% of the respondents (banks 5 and 9) indicated that between 61% and 80% of their internal audit staff has limited skills in the use of GAS. To put it differently, for the majority (66.7%) of the respondents, between 21% and 60% of their internal audit staff has limited skills in the use of GAS. For two banks, the percentage of their internal audit staff that has limited skills in the use of GAS is between 61% and 80%, while for 1 bank it is less than or equal to 20%.
- For the purposes of this study, the term "basic skills" means that individual internal auditors' proficiency in the use of GAS is sufficient to enable them to independently apply the basic functions and commands built into the GAS (for example: they can run and interpret the results of the duplicates, sampling and summarise commands) but do not have the ability to write scripts. The survey results show that 33.3% of the respondents (banks 2, 6 and 8) indicated that at most 20% of their internal audit staff has basic skills in the use of GAS, and that 66.7% of the respondents (banks 1, 3, 4, 5, 7 and 9) indicated that between 21% and 40% of their internal audit staff has basic skills in the use of GAS.
- For the purposes of this study, the term "advanced skills" means that individual internal auditors are experienced in and can apply all the basic functions and commands built into the GAS, and also have the ability to write scripts for the automated performance of tests for internal auditing purposes. The survey results

show that 66.7% of the respondents (banks 1, 5, 6, 7, 8 and 9) indicated that at most 20% of their internal audit staff has advanced skills in the use of GAS; 22.2% of the respondents (banks 3 and 4) indicated that between 21% and 40% of their internal audit staff has advanced skills in the use of GAS, and 11.1% of the respondents (bank 2) indicated that between 41% and 60% of their internal audit staff has advanced skills in the use of GAS.

To summarise, the results with regard to the overall skillset of individual internal auditors in the use of GAS (measured as limited, basic or advanced) indicates that the skills of individual internal auditors need to be improved. Section 3.5.2 indicates that the level of competency required of internal auditors in the use of GAS is an important factor contributing to or inhibiting the adoption of GAS by internal audit functions. The presence of individual internal auditors with lower skillsets with respect to the use of GAS could therefore contribute to the determination of a lower level of maturity in the use of GAS as it pertains to the people aspect of internal audit functions for tests of controls purposes.

While the individual internal auditors' skillsets in the use of GAS for tests of controls purposes is less than optimal, 55.6% of the respondents (banks 2, 3, 4, 7 and 9) indicate that they have separate data analytics teams, and that the members of these teams exhibit advanced skills in the use of GAS (i.e., they are sufficiently experienced to be able to apply all the basic functions and commands built into the GAS, and also have the ability to write scripts for the automated performance of tests for the rest of the internal audit function). In addition, 77.8% of the responding banks (banks 2, 3, 4, 5, 7, 8 and 9) also have individuals with specialist skills such as **Data Specialists** (who have a sufficiently detailed understanding of IT infrastructure and data sources to be able to access the data), and/or **ERP systems specialists** (who have expert knowledge of ERP systems such as SAP or Oracle) to support and enable the internal audit function to conduct data analytics with the use of GAS within their respective internal audit functions using GAS. Internal audit functions that display these characteristics are normally considered to be operating on higher levels of maturity when compared to those internal audit functions that do not have these characteristics (refer to section 3.7). This should therefore also contribute positively when evaluating the overall skillset maturity (i.e., the individual internal auditors together with the specialists) in the use of GAS for tests of controls purposes. The maturity assessment of the people aspect is discussed in section 4.5.1.

Additional factors that contribute to or motivate internal audit staff to improve their skills in the use of GAS (as discussed in section 3.7) in order to embrace data analytics are, (1) buy-in and support from audit management for the use of GAS as part of the internal audit methodology; (2) the incorporation of the use of GAS as one of the Key Performance Areas for individual internal auditors, and (3) to offer higher levels of remuneration for those internal audit staff members with specialist data analytics skills.

Firstly, while the literature review identified the lack of buy-in and support from the CAE or audit management as one of the important factors impeding the adoption of GAS by internal audit functions (refer to section 3.5.2), it appears that in this study the buy-in and support from the CAEs and audit management is not a factor or reason behind those internal audit functions with a lower level of maturity with regard to the people aspect: 88.9% of the respondents (banks 1, 2, 3, 4, 5, 6, 7 and 9) indicate that they do have buy-in and support from audit management for the use of GAS as part of their internal audit methodology.

Secondly, 44.4% of the respondents (banks 3, 4, 7 and 9) indicated that the use of GAS is already one of their Key Performance Areas for internal audit staff members. In other words, just less than half of the respondents indicate that the use of GAS is one of their internal audit staff members' Key Performance Areas. Thirdly, 33.3% of the respondents (banks 2, 3 and 8) indicate that higher levels of remuneration and/or reward are linked to internal audit staff with specialised data analytics skillsets appropriate to the use of GAS, which has been done in an effort to attract and retain these skills within their internal audit functions.

In conclusion, it is evident that the respondents are doing well with regard to the buy-in and support from audit management and the CAE to incorporate the use of GAS as part of the internal audit methodology. However, the use of GAS as one of the Key Performance Areas for internal auditors' performance evaluations, and the higher levels of remuneration for those internal audit staff members with specialist data analytics skills, achieved low response levels which also adversely impacts on the level of maturity in the use of GAS achieved for the maturity aspect of people.

Another important aspect in determining the maturity of the use of GAS by internal audit functions for tests of controls is the aspect of the processes that are in place that support and enable the use of GAS: these are discussed in section 4.4.4.

4.4.4 Processes in place that enable and support the use of GAS

The aspect of processes addresses the fact that data analytics should be integrated in all phases of the internal audit engagement (as discussed in section 3.7). It refers to the processes that are in place that should support and enable the use of GAS. To this end, 55.6% of the respondents (banks 2, 3, 4, 7 and 9) indicated that their banks' internal audit functions have formalised and implemented procedures, standards, and documentation and offer training that provides guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement. This should contribute positively to the maturity assessment of the process aspect of these internal audit functions. In contrast, 44.4% of the respondents (banks 1, 5, 6, and 8) indicated that their internal audit functions' use of GAS is an informal arrangement; thus it is up to the individual internal auditor to decide whether or not to make use of GAS, as he/she deems fit. Informal arrangements with regard to the use of GAS will adversely impact the maturity assessment of the process aspect of such internal audit functions. The maturity assessment of the process aspect is discussed in section 4.5.2.

The following responses (as displayed in Figure 4.6) are all strong characteristics with regard to the aspect of processes in place to support and enable the use of GAS within internal audit functions. In other words, internal audit functions that display these characteristics are normally associated with higher levels of maturity in the use of GAS for tests of controls purposes. It appears that the majority of the respondents do not currently display these characteristics, as can be seen from the responses analysed next.

The responses were as follows:

- Only 33.3% of the respondents (banks 3, 4 and 7) indicated that their bank's use of GAS is standard practice throughout their internal audit function for tests of controls purposes (i.e., it is integrated in all audit programs) (refer to question 4.2 in Figure 4.6).
- Only 33.3% of the respondents (banks 3, 4 and 9) indicated that their banks have developed data analytics scripts that have been through a quality assurance review, are defined, and are readily available for use by their respective internal auditors (refer to question 4.3 in Figure 4.6).
- Only 11.1% of the respondents (bank 3) indicated that their bank has developed and tested comprehensive suites of tests, and that they are available in a central, controlled environment for use by the internal audit staff (refer to question 4.4 in Figure 4.6).
- Only 22.2% of the respondents (banks 2 and 3) indicated that their banks have custom-built, automated scripting and testing in place, and that this is running according to a predefined schedule (i.e., continuous auditing has been achieved) (refer to question 4.5 in Figure 4.6). The implementation of continuous auditing is therefore not at a mature level in a majority of internal audit functions in the locally controlled banking industry of South Africa (77.8% - banks 1, 4, 5, 6, 7, 8 and 9). This limited use of continuous auditing also corresponds with the overall global trend that has been identified by the IIA's Research Foundation (2015a:5) in their 2015 (CBOK) report entitled *Staying a step ahead: Internal audit's use of technology* in which a slowly growing trend of 7% was identified over the period 2006 to 2015 with regard to the implementation of continuous auditing by global internal audit functions (refer to section 3.6).
- Only 22.2% of the respondents (banks 2 and 3) indicated that their banks have real-time data monitoring, with system workflow processes in place through which the control owners in the respective business units in the banks are notified of exceptions, and that they are then able to respond to them (i.e., continuous monitoring has been achieved) (refer to question 4.6 in Figure 4.6).

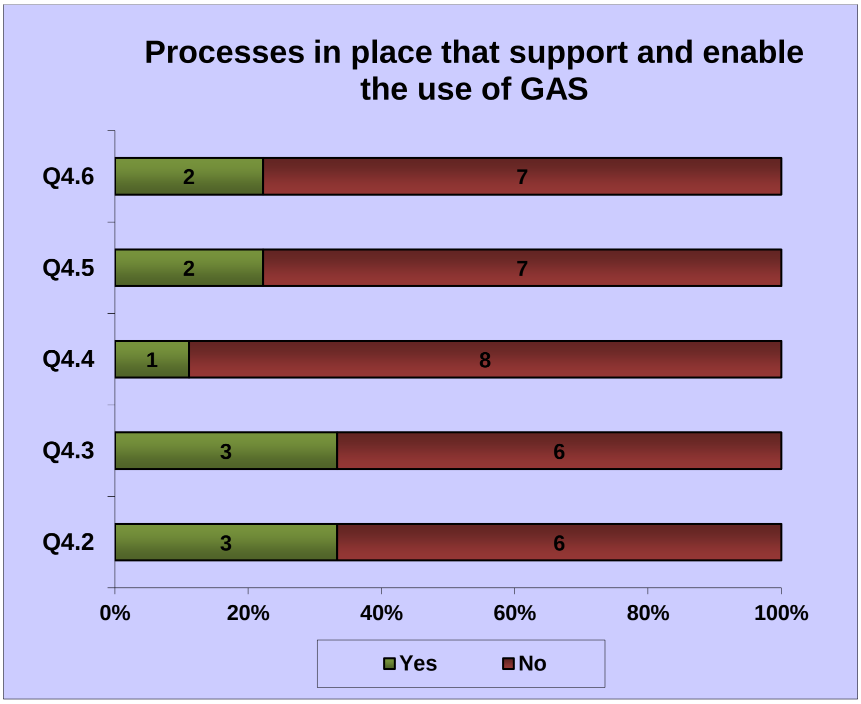


Figure 4.6: Processes in place that support and enable the use of GAS

Furthermore, the frequency of the use of GAS by internal audit functions is a strong indicator of the maturity of such an internal audit function's use of GAS for tests of controls purposes (also refer to section 4.4.2). In other words, the more frequently GAS is used, the higher the level of maturity that can be expected of such an internal audit function. Section 2.2.3 highlights the current focus on risk based internal auditing, and the increasing use of GAS should assist internal audit functions to identify risks or areas within the control environment that warrant further emphasis for internal audit engagement purposes. In addition, section 3.5.1 also emphasises the effectiveness of GAS for conducting risk assessments, amongst other tasks, through the identification of outliers, anomalies and trends that warrant further emphasis because they pose higher risk for tests of controls purposes. To this end, the research results revealed that the use of GAS for risk based **annual audit planning** purposes is the exception rather than the norm (i.e., the majority of banks **do not** use GAS to identify areas in the bank, based on the risk associated with such areas, that warrant sufficient emphasis for inclusion as an engagement on the annual audit coverage plan). The significant majority of the respondents (77.8% - banks 1, 2, 5, 6, 7, 8 and 9) indicated that GAS was *never to rarely* used to conduct risk-based annual audit planning. There were only two banks (banks 3 and 4) where it was *often to always* used for this purpose.

Similarly, the frequency of the use of GAS for risk based **engagement planning** purposes (i.e., the identification of high risk areas or anomalies that warrant further emphasis and inclusion in the engagement scope) was also at a relatively low level with the majority of the respondents (77.8% - banks 1, 2, 5, 6, 7, 8 and 9) indicating that GAS was *rarely to sometimes* used to conduct risk based engagement audit planning. However, banks 3 and 4 indicated that GAS is *often to always* used for this purpose. In the same way, the frequency of the use of GAS for risk identification purposes during the conduct of individual audit engagements (i.e., during the fieldwork stage) is also not at a high level. Just more than half of the respondents (55.6% - banks 1, 2, 5, 7 and 8) indicated that GAS was *rarely* used for risk identification purposes during individual audit engagements. Banks 6 and 9 indicated they *sometimes* use GAS for this purpose, and only banks 3 and 4 indicated they *often* use GAS for risk identification purposes.

With reference to the frequency of the use of GAS to identify the purpose for which GAS is used during separate/individual internal audit engagements (i.e., the **fieldwork** phase of an engagement), it was evident that the respondents are utilising GAS for a variety of purposes during the conduct of an individual internal audit engagement (refer to the second research objective as defined in section 1.2). A tendency to use GAS more frequently for specific purposes was also noticeable. The responses are therefore ranked from highest to the lowest frequency of use and graphically depicted in Figure 4.7.

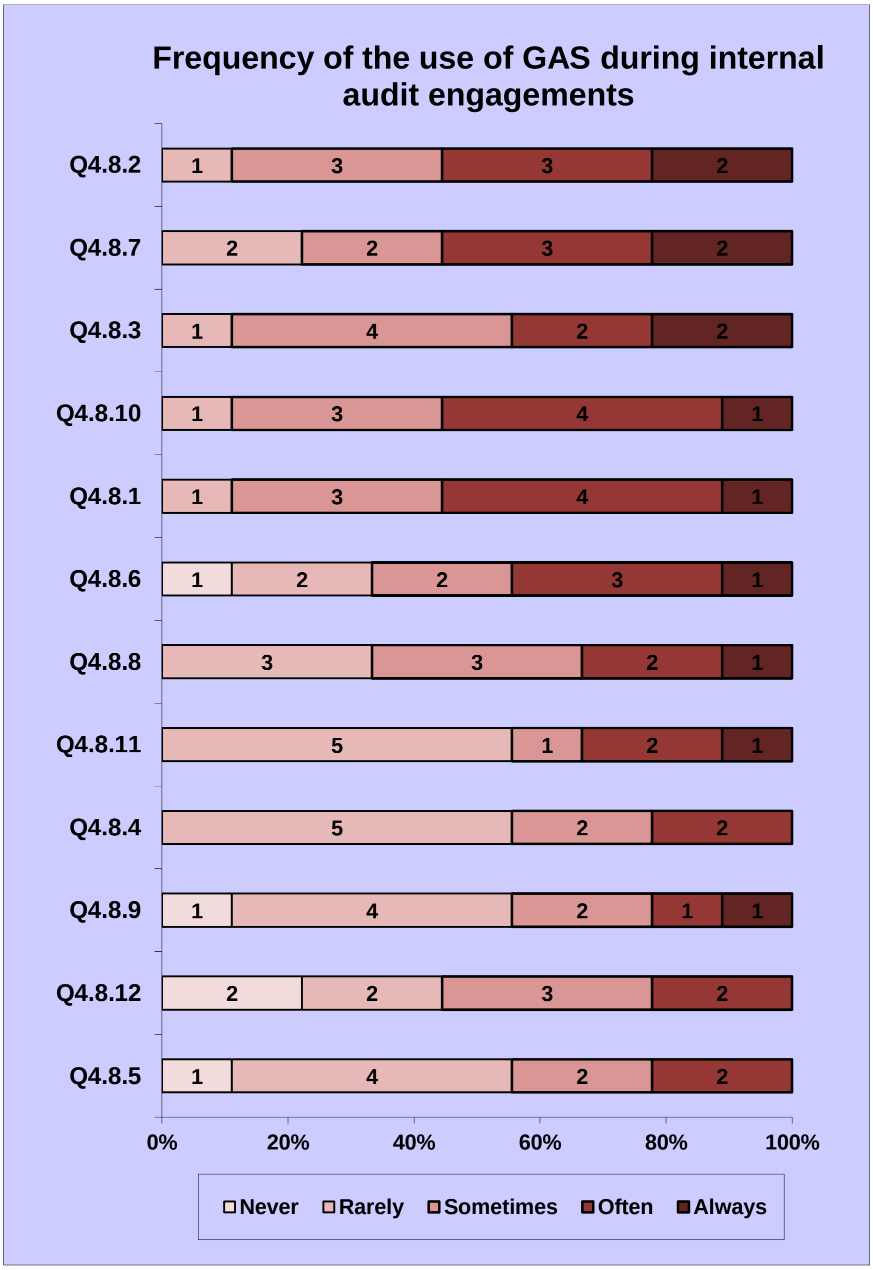


Figure 4.7: Frequency of the use of GAS during internal audit engagements

The following results refer to the frequency of the use of GAS during different types of internal audit engagements for the following listed purposes (ranked from most frequently used to least frequently used):

- To identify transactions with specific characteristics or control criteria for tests of control purposes (11.1% of the respondents (bank 5) indicated rarely, 33.3% (banks 1, 2 and 6) indicated sometimes, 33.3% (banks 4, 8 and 9) indicated often and 22.2% (banks 3 and 7) indicated always) (refer to question 4.8.2 in Figure 4.7).

- For conducting full population analysis (22.2% of the respondents (banks 1 and 5) indicated rarely, 22.2% (banks 2 and 6) indicated sometimes, 33.3% (banks 4, 8 and 9) indicated often and 22.2% (banks 3 and 7) indicated always) (refer to question 4.8.7 in Figure 4.7).
- To identify account balances over a certain amount (11.1% of the respondents (bank 5) indicated rarely, 44.4% (banks 1, 2, 6 and 9) indicated sometimes, 22.2% (banks 4 and 8) indicated often and 22.2% (banks 3 and 7) indicated always) (refer to question 4.8.3 in Figure 4.7).
- The results of the data analysis are used to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events (11.1% of the respondents (bank 5) indicated rarely, 33.3% (banks 1, 2 and 6) indicated sometimes, 44.4% (banks 4, 7, 8 and 9) indicated often and 11.1% (bank 3) indicated always) (refer to question 4.8.10 in Figure 4.7).
- To obtain audit evidence about control effectiveness (11.1% of the respondents (bank 5) indicated rarely, 33.3% (banks 1, 2 and 6) indicated sometimes, 44.4% (banks 3, 4, 8 and 9) indicated often and 11.1% (bank 7) indicated always) (refer to question 4.8.1 in Figure 4.7).
- For selecting random samples for tests of control purposes from key electronic files (11.1% of the respondents (bank 6) indicated never, 22.2% (banks 1 and 5) indicated rarely, 22.2% (banks 2 and 9) indicated sometimes, 33.3% (banks 3, 4 and 8) indicated often and 11.1% (bank 7) indicated always) (refer to question 4.8.6 in Figure 4.7).
- To re-perform procedures (33.3% of the respondents (banks 2, 5 and 8) indicated rarely, 33.3% (banks 1, 6 and 9) indicated sometimes, 22.2% (banks 3 and 4) indicated often and 11.1% (bank 7) indicated always) (refer to question 4.8.8 in Figure 4.7).
- The results of data analysis are used to conduct a root cause analysis to establish why a certain control was not working effectively (55.6% of the respondents (banks 1, 2, 5, 8 and 9) indicated rarely, 11.1% (bank 6) indicated sometimes, 22.2% (banks 3 and 4) indicated often and 11.1% (bank 7) indicated always) (refer to question 4.8.11 in Figure 4.7).

- For risk identification purposes (55.6% of respondents (banks 1, 2, 5, 7 and 8) indicated rarely, 22.2% (banks 6 and 9) indicated sometimes and 22.2% (banks 3 and 4) indicated often) (refer to question 4.8.4 in Figure 4.7).
- For the generation of exception reports through continuous auditing (11.1% of the respondents (bank 8) indicated never, 44.4% (banks 1, 5, 7 and 9) indicated rarely, 22.2% (banks 2 and 6) indicated sometimes, 11.1% (bank 4) indicated often and 11.1% (bank 3) indicated always) (refer to question 4.8.9 in Figure 4.7).
- The results of the data analysis are used to identify trends and to predict future risk events (22.2% of the respondents (banks 1 and 8) indicated never, 22.2% (banks 5 and 6) indicated rarely, 33.3% (banks 2, 7 and 9) indicated sometimes and 22.2% (banks 3 and 4) indicated often) (refer to question 4.8.12 in Figure 4.7).
- To evaluate fraud risks (11.1% of the respondents (bank 8) indicated never, 44.4% (banks 1, 5 , 6 and 9) indicated rarely, 22.2% (banks 2 and 7) indicated sometimes and 22.2% (banks 3 and 4) indicated often) (refer to question 4.8.5 in Figure 4.7).

Reviewing the results (with specific reference to questions 4.8.10, 4.8.11 and 4.8.12) it is evident that the locally controlled banking industry's internal auditors' "line of sight" (refer to section 3.7) is predominantly focused on delivering descriptive analytics (hindsight) (i.e., it is focused on answering questions such as "what happened?"). This view is derived from the responses to question 4.8.10, (*"the results of the data analysis are used to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events"*) which only ranked as the fourth highest purpose for which GAS is applied. Descriptive statistics are the primary or most basic forms of data analytics, as was mentioned in section 3.7, and this situation therefore also provides an indication of the level of the maturity of the use of GAS by such internal audit functions. On the other hand, data analytics that are focused on answering questions such as "why did it happen?" are regarded as diagnostic analytics (providing insight). Based on responses to question 4.8.11 it is clear that the use of GAS for the purpose of conducting a root cause analysis (i.e., establishing "why" a certain control was not working effectively) is not frequently used (it was ranked in the bottom five of all the various purposes for which GAS could be used). In addition, data analytics that are performed to provide a view on the likelihood of anticipated events (to predict future risk events), is classified as predictive analytics (provides foresight). It should be noted that internal audit functions that provide predictive data analytics through the use of GAS are associated with higher levels of maturity in the use of GAS for tests of controls purposes. Reviewing the responses to question 4.8.12, it is clear that GAS is infrequently used to conduct predictive analytics (it was ranked second lowest of all the listed purposes for which GAS can be used). The exceptions to this ranking were banks 3 and 4. The frequency with which GAS is used for predictive purposes also provides insight regarding the level of maturity of the use of GAS in these respective banks.

The last phase of the systematic internal audit approach is to conduct **monitoring and follow-up,** in an effort to verify whether management has taken action on previously reported audit findings (refer to section 2.2.3). The use of GAS can also be used for this purpose: 22% of the respondents (banks 6 and 8) *never* store audit-specific data in GAS for monitoring and follow-up purposes; 22.2% (banks 1 and 5) indicated that audit-specific data is *rarely* stored in GAS for monitoring and follow-up purposes; 11.1% (bank 2) indicated it is *sometimes* stored in GAS; 33.3% (banks 4 ,7 and 9) indicated that audit-specific data is *often* stored in GAS for monitoring and follow-up purposes, and 11.1% (bank 3) indicated that it is *always* stored in GAS to support and inform monitoring and following-up on previously reported audit findings at their banks. In brief, just over half (55.6%) of the respondents indicated that audit-specific data is *never to sometimes* stored in GAS for this purpose.

The third important aspect in determining the maturity of the use of GAS by internal audit functions for tests of controls is the aspect of the technology platform that is in place to enable the performance of data analytics. This is discussed next.

4.4.5 The technology platform that enables the performance of data analytics

Most internal audit functions are faced with significant initial costs with regard to the purchase and implementation of the technology platform that supports and enables the data analytics effort (IIA, 2016o:56). The issue of cost implications with regard to the purchase of commercially available software packages was also cited as one of the impeding factors, believed to hinder the adoption of GAS by internal audit functions (as was discussed in section 3.5.2). There are however various CAATs tools available to the internal auditor that are useful in conducting data analysis, as was mentioned in section 4.4.2. The most common data analysis tool that is currently used by the internal audit functions in the locally controlled banking industry in South Africa was identified as the GAS package called ACL (refer to section 4.4.2). Consideration of the use of appropriate data analysis tools (i.e., the specific CAATs tool, or for the purpose of this study, the GAS tool) is not the only aspect to consider under the technology platform. Equally important are the issues of access to, and availability, accuracy, completeness and integrity of the data, amongst others, within the various banks' or organisations' control environments (refer to section 3.5.2).

The following responses provide insight regarding the technology platforms that are currently available to the internal audit functions of the locally controlled South African banking industry:

- The majority of the respondents (77.8% - banks 1, 4, 5, 6, 7, 8 and 9) indicated that it is difficult for the internal audit function to obtain access to the organisational data without support from IT. On the other hand, 44.4% of the respondents (banks 2, 3, 4 and 9) also indicated that they do have an established data access protocol with the IT department that enables them to obtain data for audit and analytical purposes. Upon seeking further clarification from respondents 4 and 9 it was established that they still encounter access problems in certain areas within their respective control environments, and this therefore explains their responses provided in this regard. This issue of data access has also been consistently identified as a top concern in a majority of the international studies reviewed (refer to section 3.5.2), and that this adversely impacts on the internal audit functions' decisions on whether to integrate the use of GAS and data analytics into their respective audit methodologies.
- Less than half of the respondents (44.4% - banks 2, 4, 6 and 9) indicated that complex processing of large data volumes is performed on high-powered servers.
- Less than half of the respondents (44.4% - banks 2, 3, 6 and 7) indicated that they do have access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes.

- Only 33.3% of the respondents (banks 2, 4 and 9) have advanced analytics in place, that are available for use within the internal audit function, and which have been developed by their data analysis specialists who also have expert knowledge of ERP systems.
- Only 22.2% of the respondents (banks 3 and 9) have an automated data extraction, transfer and load capability for data analysis purposes.
- Only 22.2% of the respondents (banks 4 and 9) have a well-structured and centrally-managed server environment which stores and maintains large data sets and the contents of the audit analytics processes.

Reviewing the results, it is evident that banks 2, 3, 4 and 9 consistently responded positively, confirming that most of the characteristics (from a technology perspective) are present within their respective internal audit functions. The presence and functionality of these technological attributes is also indicative that a higher level of maturity is being displayed by these banks (with regard to the technology aspect), as is indicated in section 4.5.3.

In addition to the characteristics of the technology platform described, it is important to note that the use of data visualization tools for reporting purposes also contributes to enhancing the assessed level of maturity that can be achieved from a technology perspective. The results revealed that 22.2% of the respondents (banks 6 and 8) *never* make use of data visualization tools for reporting purposes; 33.3% (banks 1, 7 and 9) indicated that they *rarely* make use of them; 33.3% (banks 3, 4 and 5) indicated that they *sometimes* make use of data visualization tools for reporting purposes, and 11.1% (bank 2) indicated that they *often* make use of these tools. To put it differently, a majority of the internal audit functions (88.9% - banks 1, 3, 4, 5, 6, 7, 8 and 9) do not make use of data visualization tools *very often* for reporting purposes. Bank 2 was the exception, indicating that they *often* use data visualization tools for reporting purposes.

The next section provides an overview of the overall levels of perceived satisfaction respondents experience with the degree to which GAS has been implemented within their internal audit functions in the locally controlled banking industry of South Africa.

4.4.6 The levels of satisfaction with the current degree to which GAS has been implemented

Reviewing the results reported in sections 4.4.2 – 4.4.5 it is evident that the implementation of GAS within the internal audit functions of the locally controlled banking industry is still not optimal, and that there is still room for improvement in all of the aspects (namely, people, process and technology) that contribute to the maturity of the use of GAS for data analytics purposes. This is confirmed through the responses provided by the respondents regarding their current levels of satisfaction with the degree to which GAS has been implemented within their internal audit functions. 66.7% of the respondents (banks 1, 2, 5, 6, 8 and 9) indicated that they were dissatisfied with the current degree to which GAS has been implemented by their internal audit function; 22.2% (banks 4 and 7) were neither satisfied nor dissatisfied, and 11.1% (bank 3) expressed reasonable satisfaction.

The explanations and comments offered with regard to the need to improve the use and implementation of GAS included the following:

- *"Currently do not use GAS enough. Could benefit therefrom to increase efficiency in audit approach.*
- *GAS is currently being utilised wherever possible; however, there are certain areas where the use of GAS can be enhanced and there are other areas where it is still to be implemented.*
- *Our department is in the process of enhancing our data analytics capabilities. An internal audit strategy has been drafted recently and one of its key deliverables is the implementation of continuous audit.*
- *We are at the very beginning of a long journey. Our GAS environment is not mature at this stage.*
- *We need to speed up the pace of implementing continuous control monitoring, as well as broad adoption of analytics in all audits.*
- *Advanced Microsoft Excel is extensively used, with a strategic move towards GAS currently in progress.*

- *The implementation of GAS should be an integral part of the internal audit function and as a bank we believe that it would be to the detriment of the internal audit function if such a critical function is not leveraged from an audit processing point of view and a data analytics perspective".*

It should thus be obvious that the use of GAS is currently a priority for all the CAEs of these internal audit functions and that there is a drive to increase the maturity of the use of GAS in their respective internal audit functions.

The next section provides a discussion regarding the maturity assessment that was conducted based on the results that were discussed in sections 4.4.2 – 4.4.6.

4.5 MATURITY ASSESSMENT

To reiterate, in section 3.7 it was indicated that the three aspects of maturity - people, process and technology - should be assessed jointly to achieve an overall assessment of the level of maturity displayed by internal audit functions in their use of GAS to conduct data analytics for tests of controls purposes (refer to the primary research objective as defined in section 1.2). The questionnaire and the data analytics maturity framework used in this study were therefore designed specifically to obtain evidence regarding each of these three aspects, namely people, process and technology (refer to section 1.4).

For those questions that produced numerical data, the nature of the data collected was considered from the standpoint of creating mutually exclusive categories that correspond to the different levels of maturity. The open-ended questions that resulted in non-numerical data yielded information that provided more in-depth insight into the maturity levels of the individual banks (also refer to sections 4.4.4 – 4.4.6). The data analytics maturity framework and the questionnaire used in this study are included as Annexures B and C respectively.

Each of the characteristics or variables included in the questionnaire and the data analytics maturity framework were then scrutinised and categorised as either nominal variables, interval variables or ordinal variables. For the nominal variables (which usually include “Yes/No” (1/0 value) type answers), the actual questions were scrutinised to determine whether a “Yes” or a “No” response to the questions would contribute to the maturity of the use of GAS by internal audit functions in the South African banking industry. With regard to the interval variables in the survey, the means and standard deviations were determined to identify the central tendencies and the variations around these centres of the distribution in order to identify cut-off points which would determine the levels of maturity. The ordinal variables (where the respondents indicated the frequency or percentage of use according to Likert scale options) were also scrutinised and a unique scoring allocation with regard to each of the Likert scale options was conducted. These are presented in the next three sections.

The following sections (4.5.1 – 4.5.3) provide a discussion with regard to the scoring allocations (i.e., maturity assessment) for each aspect (people, processes and technology). It shows the method of determining the scoring of each question, leading to the overall scoring of each aspect (people, process, technology), as well as the overall maturity assessment for each bank (refer to section 4.5.4).

4.5.1 Maturity assessment for the people aspect

Table 4.1 represents all the variables used, as well as the type of variable (from a statistical perspective), for determining the level of maturity of the use of GAS by internal audit functions in the South African banking industry as it applies to the aspect of people.

Table 4.1: Variables used to determine the maturity of the people aspect in the use of GAS

QUESTION NUMBER	QUESTION	VARIABLE TYPE
Q3.1	What percentage of internal audit staff has limited skills in the use of GAS?	Ordinal
Q3.2	What percentage of internal audit staff has basic skills in the use of GAS?	Ordinal
Q3.3	What percentage of internal audit staff exhibits advanced skills in the use of GAS?	Ordinal
Q3.4	Does your internal audit department also have a data analytics team that exhibits advanced skills in the use of GAS?	Nominal
Q3.4.1	If yes how many staff members?	Interval
Q3.5	Within your internal audit function, do you also have individuals with specialist skills such as Data Specialists, and/or ERP systems specialists to support and enable the internal audit function to conduct data analytics with the use of GAS?	Nominal
Q3.5.1	If yes indicate how many specialists?	Interval
Q3.6.1	The use of GAS is one of your internal audit staff's Key Performance Areas (KPA's).	Nominal
Q3.6.2	Higher levels of remuneration and/or reward is linked to internal audit staff with specialized data analytical skillsets in the use of GAS, in an effort to attract and retain these skills within your audit function.	Nominal
Q3.6.3	There is buy-in and support from audit management for the use of GAS as part of the internal audit methodology.	Nominal
Q6.1	How satisfied are you with the current degree to which GAS has been implemented by your internal audit function?	Ordinal

The scoring allocation for question 3.1 was reversed due to the nature of the question. In other words, the more limited the skills are the less mature the internal audit function will be, with respect to use of GAS. Thus, the higher the percentage indicating possession of limited skills by internal audit staff in the use of GAS, the lower the maturity level of their use of GAS, and vice versa. The scoring for question 3.1 was thus allocated as follows:

- 0-20% scored 5.
- 21-40% scored 4.
- 41-60 scored 3.
- 61-80% scored 2.
- 81-100% scored 1.

The scoring for questions 3.2 and 3.3 was as follows:

- 0-20% scored 1.
- 21-40% scored 2.
- 41-60 scored 3.
- 61-80% scored 4.
- 81-100% scored 5.

For question 6.1, the more satisfied the respondents were with the current degree to which GAS has been implemented by their internal audit functions, the higher their maturity level in the use of GAS, from the people perspective. The scoring for question 6.1 was as follows:

- "Significantly dissatisfied: requires major improvement" was coded as 1.
- "Dissatisfied: requires improvement" was coded as 2.
- "Neither satisfied or dissatisfied: functional but not yet optimal" was coded as 3.
- "Reasonably satisfied: however, some improvement may be required" was coded as 4.
- "Very satisfied: no improvement required" was coded as 5.

For all the nominal variables (questions 3.4, 3.5, 3.6.1, 3.6.2 and 3.6.3) where the respondents could only indicate “Yes/No”, the rationale was as follows: a “Yes” response would contribute positively to the maturity level in the use of GAS from a people perspective, whereas a “No” response would adversely impact the level of maturity for this aspect. Thus, the scoring for questions 3.4, 3.5, 3.6.1, 3.6.2 and 3.6.3 were allocated as follows:

- Yes scored 1.
- No scored 0.

For the two interval variables (questions 3.4.1 and 3.5.1), where the respondents firstly indicated the number of staff members in their data analytics team and secondly the number of data specialists, and/or ERP systems specialists, the means and standard deviations were calculated and the following scores were allocated:

For question 3.4.1 (refer to Annexure L for the scoring calculation):

- If a data analytics team does not exist within the internal audit function then a score of 0 was allocated.
- If the number of staff members within their data analytics team was between 1 and <5 a score of 2 was allocated.
- If the number of staff members within their data analytics team was between 5 and <13 a score of 3 was allocated.
- If the number of staff members within their data analytics team was between 13 and <20 a score of 4 was allocated.
- If the number of staff members within their data analytics team was 20 or more, a score of 5 was allocated.

For question 3.5.1 (refer to Annexure M for the scoring calculation):

- If the internal audit function does not have any data specialist and/or ERP systems specialists then a score of 0 was allocated.

- If the number of data specialists and/or ERP systems specialists was between 1 and <4 a score of 2 was allocated.
- If the number of data specialists and/or ERP systems specialists was between 4 and <7 a score of 3 was allocated.
- If the number of data specialists and/or ERP systems specialists was between 7 and <11 a score of 4 was allocated.
- If the number of data specialists and/or ERP systems specialists was 11 or greater, a score of 5 was allocated.

It should be noted that the scoring allocation for questions 3.1, 3.2, 3.3, 3.4.1, 3.4.5 and 6.1 resulted in a maximum of 5 points (due to the nature of these questions), compared to the other questions where a maximum score of 1 could be allocated. For this reason, the scoring allocations for all these questions were adjusted in order to ensure that each question contributed equally (i.e., a maximum score value of 1) to the total maximum score for this aspect. This was achieved by dividing all these questions by 5, which meant that each of these questions could also only contribute a maximum of 1 point.

The results of the scoring for the previously mentioned questions are reflected in Table 4.2. The total score for all the questions for each bank is listed at the bottom of the table. This score is then presented as a percentage of the maximum possible score a bank could have achieved for this aspect. This percentage is the score on which the banks were assigned to a maturity level with respect to their use of GAS, from a people perspective, in their internal audit functions.

Table 4.2: Maturity scoring with respect to the people aspect for each bank

QUESTION NUMBER	BANK 1	BANK 2	BANK 3	BANK 4	BANK 5	BANK 6	BANK 7	BANK 8	BANK 9	Maximum score per question
Q3.1	0,6	0,6	0,6	0,8	0,4	0,8	1	0,8	0,4	1
Q3.2	0,4	0,2	0,4	0,4	0,4	0,2	0,4	0,2	0,4	1
Q3.3	0,2	0,6	0,4	0,4	0,2	0,2	0,2	0,2	0,2	1
Q3.4	0	1	1	1	0	0	1	0	1	1
Q3.4.1	0	0,6	0,4	1	0	0	0,6	0	0,6	1
Q3.5	0	1	1	1	1	0	1	1	1	1
Q3.5.1	0	0.4	0,4	1	0,4	0	0,6	0,4	0,6	1
Q3.6.1	0	0	1	1	0	0	1	0	1	1
Q3.6.2	0	1	1	0	0	0	0	1	0	1
Q3.6.3	1	1	1	1	1	1	1	0	1	1
Q6.1	0,4	0,4	0,8	0,6	0,4	0,4	0,6	0,4	0,4	1
Total Score	**2,6**	**7**	**8**	**8,2**	**3,8**	**2,6**	**7,4**	**4**	**6,6**	**11**
Value as percentage of maximum score	**24%**	**62%**	**73%**	**75%**	**35%**	**24%**	**67%**	**36%**	**60%**	**100%**

The mean and the standard deviation were calculated for the total score [mean – 5.6; standard deviation - 2.2]. Then the ranges (expressed as a percentage of the maximum possible score) to which the various maturity levels were allocated were assigned as follows:

- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 0 and less than 12, a maturity level of 0 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 12 and less than 31, a maturity level of 1 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 31 and less than 51, a maturity level of 2 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 51 and less than 71, a maturity level of 3 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 71 and less than 90, a maturity level of 4 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) was 90 and more a maturity level of 5 was allocated.

Figure 4.8 illustrates the distribution of the different levels of maturity achieved for each bank with regard to the aspect of people.

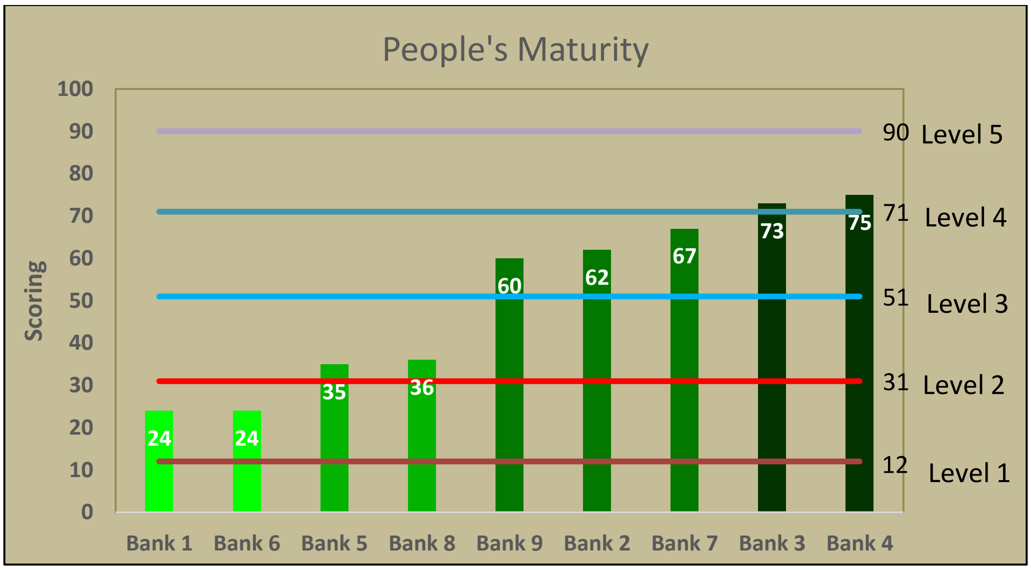


Figure 4.8: Maturity assessment: People

Reviewing the results from Figure 4.8 it is clear that the ability of internal audit team members to embrace data analytics using GAS is not yet optimal and that there is still much room for improvement. To summarise, 44.4% of the respondents (banks 1, 5, 6 and 8) demonstrated a low level of maturity (level 1 and 2) with regard to the aspect of people. Another 33.3% of the respondents (banks 2, 7 and 9) demonstrated a medium level of maturity (level 3) for this aspect. There were only two respondents (banks 3 and 4) that achieved a high level of maturity (level 4) with regard to the aspect of people. Section 4.5.4 contains a summary of the overall maturity allocation per aspect for each bank.

4.5.2 Maturity assessment for the process aspect

Table 4.3 represents all the variables, as well as the types of variable (from a statistical perspective) used for determining the level of maturity of the use of GAS by internal audit functions in the South African banking industry, as it applies to the aspect of process.

Table 4.3: Variables used to determine the maturity of the process aspect in the use of GAS

QUESTION NUMBER	QUESTION	VARIABLE TYPE
Q4.1	Select one of following statements that best describes your internal audit function's use of GAS.	Nominal
Q4.2	The use of GAS is standard practice throughout your internal audit function for tests of controls purposes.	Nominal
Q4.3	Previously developed data analytics scripts that have been through a quality assurance review are defined and are readily available for use by the respective auditors.	Nominal
Q4.4	Comprehensive suites of tests have been developed and tested, and are available in a central, controlled environment for use by the internal audit staff.	Nominal

QUESTION NUMBER	QUESTION	VARIABLE TYPE
Q4.5	Custom-built automated scripting and testing is in place and is running according to a predefined schedule.	Nominal
Q4.6	There are real-time data monitoring with system workflow processes.	Nominal
Q4.7.1	Frequency of use of GAS to conduct risk-based annual audit planning.	Ordinal
Q4.7.2	Frequency of use of GAS for engagement planning purposes.	Ordinal
Q4.7.3	Frequency of use of GAS to audit specific data stored in GAS.	Ordinal
Q4.7.4	Frequency of use of GAS for Other.	Ordinal
Q4.8.1	Frequency internal audit function make use of GAS to obtain audit evidence about control effectiveness.	Ordinal
Q4.8.2	Frequency internal audit function makes use of GAS to identify transactions with specific characteristics or control criteria for tests of control purposes.	Ordinal
Q4.8.3	Frequency internal audit function makes use of GAS to identify account balances over a certain amount.	Ordinal
Q4.8.4	Frequency internal audit function makes use of GAS for risk identification purposes.	Ordinal
Q4.8.5	Frequency internal audit function makes use of GAS to evaluate fraud risks.	Ordinal
Q4.8.6	Frequency internal audit function makes use of GAS for selecting random samples for tests of control purposes from key electronic files.	Ordinal
Q4.8.7	Frequency internal audit function makes use of GAS for conducting full population analysis.	Ordinal
Q4.8.8	Frequency internal audit function makes use of GAS to	Ordinal

QUESTION NUMBER	QUESTION	VARIABLE TYPE
	re-perform procedures.	
Q4.8.9	Frequency internal audit function makes use of GAS for the generation of exception reports through continuous auditing.	Ordinal
Q4.8.10	Frequency internal audit function makes use of GAS to use the results of the data analysis to identify and report on the frequency and occurrence of risks or frequency of occurrence of specific events.	Ordinal
Q4.8.11	Frequency internal audit function makes use of GAS to use the results of the data analysis to conduct a root cause analysis to establish why a certain control was not working effectively.	Ordinal
Q4.8.12	Frequency internal audit function makes use of GAS to use the results of the data analysis to identify trends and to predict future risk events.	Ordinal
Q4.8.13	Frequency internal audit function makes use of GAS for "Other" purposes.	Ordinal
Q4.9	Do you believe GAS can be utilised more frequently than it is at present, within you internal audit function?	Nominal
Q6.1	How satisfied are you with the current degree to which GAS has been implemented by your internal audit function?	Ordinal

For the nominal variable (question 4.1) where the respondents could indicate:

- “The use of GAS is an informal arrangement: it is up to the individual internal auditor to decide whether or not to make use of GAS as he/she deems fit”.
- “The internal audit function has formalised and implemented procedures, standards, and documentation, and offers training that provide[s] guidance to the

internal audit staff on how GAS and data analytics should be applied on an internal audit engagement".

If the respondents answered that the internal audit function has formalised and implemented procedures, standards, and documentation, and offers training that provides guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement, it was deemed to be using a more mature approach. If the use of GAS is an informal arrangement, by comparison, and it is up to the individual internal auditor to decide whether or not to make use of GAS, that internal audit function was assessed as using a less mature approach. Thus the scoring for question 4.1 was allocated as follows:

- "The use of GAS is an informal arrangement: it is up to the individual internal auditor to decide whether or not to make use of GAS as he/she deems fit" scored 0.5.
- "The internal audit function has formalised and implemented procedures, standards, and documentation, and offers training that provide guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement" scored 1.

For all the other nominal variables (questions 4.2, 4.3, 4.4, 4.5 and 4.6) where the respondents could only indicate "Yes/No" the rationale was as follows: a "Yes" response would contribute positively to the maturity level in the use of GAS from a process perspective, whereas a "No" response would adversely impact the level of maturity for this aspect. Thus, the scoring for questions 4.2, 4.3, 4.4, 4.5 and 4.6 were allocated as follows:

- Yes scored 1.
- No scored 0.

For the nominal variable (question 4.9), where the respondents could only indicate "Yes/No" to the question "Do you believe GAS can be utilised more frequently than it is at present, within your internal audit function?", if respondents answered "Yes" it means that GAS is not utilised frequently at present within that bank's internal audit function, and that is why they believe GAS can be utilised more frequently than it is at present. Under such a scenario, the assessed maturity level of the function's use of GAS will be adversely impacted. Conversely, if respondents answered "No" to this question it means that GAS is already utilised frequently within the internal audit function of that bank, and thus positively contributes to the function's maturity level in the use of GAS, from a process perspective. The scoring for question 4.9 was as follows:

- Yes scored 0.
- No scored 1.

For all the ordinal variables (questions 4.7.1, 4.7.2, 4.7.3, 4.7.4, 4.8.1, 4.8.2, 4.8.3, 4.8.4, 4.8.5, 4.8.6, 4.8.7, 4.8.8, 4.8.9, 4.8.10, 4.8.11, 4.8.12 and 4.8.13), where the respondents indicated the frequency of their use of the different aspects of GAS, the scoring was allocated as follows:

- Never scored 0.
- Rarely scored 1.
- Sometimes scored 2.
- Often scored 3.
- Always scored 4.

It should be noted from the above that the scoring allocation for questions 4.7.1, 4.7.2, 4.7.3, 4.7.4, 4.8.1, 4.8.2, 4.8.3, 4.8.4, 4.8.5, 4.8.6, 4.8.7, 4.8.8, 4.8.9, 4.8.10, 4.8.11, 4.8.12 and 4.8.13 resulted in a maximum score value of 4 points (due to the nature of these questions), compared to the other questions where a maximum score of 1 could be allocated. For this reason, the scoring allocation for all these questions was adjusted in order to ensure that each question contributed equally (i.e., a maximum score value of 1) to the total maximum score for this aspect. This was achieved by dividing each of the scores for these questions by 4, which resulted in each of these questions also only contributing a maximum of 1 point.

For question 6.1, the more satisfied the respondents were with the current degree to which GAS has been implemented by their internal audit functions, the higher their maturity level should be in the use of GAS, from a process perspective. The scoring for question 6.1 was therefore allocated as follows:

- “Significantly dissatisfied: requires major improvement” is coded as 1.
- “Dissatisfied: requires improvement” is coded as 2.
- “Neither satisfied or dissatisfied: functional but not yet optimal” is coded as 3.
- “Reasonably satisfied: however, some improvement may be required” is coded as 4.
- “Very satisfied: no improvement required” is coded as 5.

It should be noted that the scoring allocation for question (6.1) resulted in a possible maximum score of 5 points (due to the nature of the question), compared to the other questions where a maximum score of 1 could be allocated. For this reason, the scoring allocation for question 6.1 was adjusted in order to ensure that each question contributed equally (i.e., a maximum score value of 1) to the total maximum score for this aspect. This was achieved by dividing this question’s score by 5, which resulted in this question also only contributing a maximum of 1 point.

The results of the scoring for the previously mentioned questions are reflected in Table 4.4, which also includes the total score for each bank. The total score for all the questions for each bank is listed at the bottom of the table. This score is then presented as a percentage of the maximum possible score a bank could have achieved for this aspect. This percentage represents the maturity level/score the banks were allocated for their use of GAS from a process perspective in their internal audit function.

Table 4.4: Maturity scoring with respect to the process aspect for each bank

QUESTION NUMBER	BANK 1	BANK 2	BANK 3	BANK 4	BANK 5	BANK 6	BANK 7	BANK 8	BANK 9	Maximum score per question
Q4.1	0,5	1	1	1	0,5	0,5	1	0,5	1	1
Q4.2	0	0	1	1	0	0	1	0	0	1
Q4.3	0	0	1	1	0	0	0	0	1	1
Q4.4	0	0	1	0	0	0	0	0	0	1
Q4.5	0	1	1	0	0	0	0	0	0	1
Q4.6	0	1	1	0	0	0	0	0	0	1
Q4.7.1	0,25	0,25	1	0,75	0,25	0	0	0	0,25	1
Q4.7.2	0,25	0,25	1	0,75	0,25	0,5	0,5	0,5	0,5	1
Q4.7.3	0,25	0,5	1	0,75	0,25	0	0,75	0	0,75	1
Q4.7.4	0	0	0	0	0	0	1	0	0	1
Q4.8.1	0,5	0,5	0,75	0,75	0,25	0,5	1	0,75	0,75	1
Q4.8.2	0,5	0,5	1	0,75	0,25	0,5	1	0,75	0,75	1
Q4.8.3	0,5	0,5	1	0,75	0,25	0,5	1	0,75	0,5	1
Q4.8.4	0,25	0,25	0,75	0,75	0,25	0,5	0,25	0,25	0,5	1
Q4.8.5	0,25	0,5	0,75	0,75	0,25	0,25	0,5	0	0,25	1
Q4.8.6	0,25	0,5	0,75	0,75	0,25	0	1	0,75	0,5	1
Q4.8.7	0,25	0,5	1	0,75	0,25	0,5	1	0,75	0,75	1

QUESTION NUMBER	BANK 1	BANK 2	BANK 3	BANK 4	BANK 5	BANK 6	BANK 7	BANK 8	BANK 9	Maximum score per question
Q4.8.8	0,5	0,25	0,75	0,75	0,25	0,5	1	0,25	0,5	1
Q4.8.9	0,25	0,5	1	0,75	0,25	0,5	0,25	0	0,25	1
Q4.8.10	0,5	0,5	1	0,75	0,25	0,5	0,75	0,75	0,75	1
Q4.8.11	0,25	0,25	0,75	0,75	0,25	0,5	1	0,25	0,25	1
Q4.8.12	0	0,5	0,75	0,75	0,25	0,25	0,5	0	0,5	1
Q4.8.13	0	0,5	0	0	0	0	0	0	0	1
Q4.9	0	0	1	0	0	0	0	0	0	1
Q6.1	0,4	0,4	0,8	0,6	0,4	0,4	0,6	0,4	0,4	1
Total score	**5.7**	**10.2**	**21.1**	**14.9**	**4.7**	**6,4**	**14,1**	**6.7**	**10,2**	**25**
Value as percentage of maximum score	**23%**	**41%**	**84%**	**59%**	**19%**	**26%**	**56%**	**27%**	**41%**	**100%**

The mean and the standard deviation were calculated for the total score [mean – 10.4; standard deviation – 5.1]. Then the ranges (expressed as a percentage of the maximum possible score) to which the maturity levels were allocated are as follows:

- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 0 and less than 1 a maturity level of 0 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 1 and less than 22 a maturity level of 1 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 22 and less than 42 a maturity level of 2 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 42 and less than 62 a maturity level of 3 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 62 and less than 83 a maturity level of 4 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) was 83 and more a maturity level of 5 was allocated.

Figure 4.9 illustrates the distribution of the different levels of maturity achieved for each bank with regard to the aspect of process.

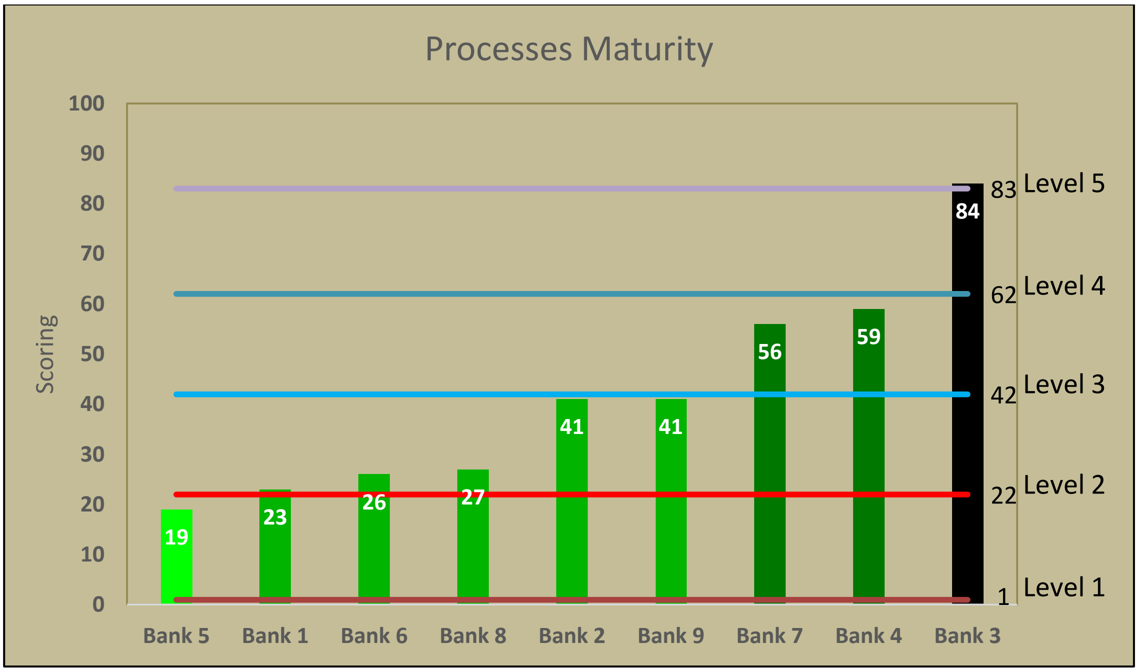


Figure 4.9: Maturity assessment: Process

Reviewing the results from Figure 4.9 it is clear that the processes in place to support and enable the use of GAS are also far from optimal in a majority of the banks' internal audit functions. To summarise, 66.7% of the respondents (banks 1, 2, 5, 6, 8 and 9) reflected a low level of maturity (level 1 and 2) with regard to the aspect of process. Another two respondents (22.2% - banks 4 and 7) achieved a medium maturity level (level 3) for this aspect, and only one respondent displayed a high level of maturity (level 5) with regard to the aspect of process. Refer to section 4.5.4 for a summary of the overall maturity allocation per aspect for each bank.

4.5.3 Maturity assessment for technology aspect

Table 4.5 represents all the variables used, as well as the types of variable (from a statistical perspective), for determining the level of maturity of the use of GAS by internal audit functions in the South African banking industry as applied to the aspect of technology.

Table 4.5: Variables used to determine the maturity of use of technology in the implementation of GAS

QUESTION NUMBER	QUESTION	VARIABLE TYPE
Q5.1	It is difficult for the internal audit function to obtain access to the organisation data without support from IT.	Nominal
Q5.2	The internal audit function has an established data access protocol with the IT department that enables it to obtain data for audit and analytical purposes.	Nominal
Q5.3	The internal audit function has a well-structured and centrally-managed server environment which stores and maintains large data sets and the contents of the audit analytics processes.	Nominal
Q5.4	The internal audit function has access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes.	Nominal

QUESTION NUMBER	QUESTION	VARIABLE TYPE
Q5.5	The internal audit function has an automated data extraction, transfer and load capability.	Nominal
Q5.6	Data analysis is performed with the use of Microsoft Excel rather than with commercial GAS packages such as ACL and IDEA.	Nominal
Q2.2.1	If your internal audit function makes use of GAS, do you use ACL?	Nominal
Q5.7	Complex processing of large data volumes is performed on high powered servers.	Nominal
Q5.8	Advanced analytics that have been developed by the data analysis specialists with export knowledge of ERP systems are in place and are available for use within the internal audit function.	Nominal
Q5.9.1	The internal audit function makes use of data visualization tools for reporting purposes.	Ordinal
Q6.1	How satisfied are you with the current degree to which GAS has been implemented by your internal audit function?	Nominal

For the nominal variables (questions 5.2, 5.3, 5.4, 5.5, 2.2.1, 5.7 and 5.8) where the respondents could only indicate “Yes/No” the rationale was as follows: a “Yes” response would contribute positively to the assessed maturity level of the function’s use of GAS from a technology perspective, whereas a “No” response would adversely impact the level of maturity for this aspect. The scoring for questions 5.2, 5.3, 5.4, 5.5, 2.2.1, 5.7 and 5.8 was as follows:

- Yes scored 1.
- No scored 0.

In contrast, for the nominal variables (questions 5.1 and 5.6), where the respondents could also only indicate “Yes/No” to the questions: “It is difficult for the internal audit function to obtain access to the organisation's data without support from IT", and "Data analysis is performed with the use of Microsoft Excel rather than with commercial GAS packages such as ACL and IDEA". If the respondents answered "Yes", it meant that it is difficult for the internal audit function to obtain access to the organisation's data without support from IT, and data analysis is performed with the use of Microsoft Excel rather than with commercial GAS packages such as ACL and IDEA. Under such a scenario, the maturity of the use of GAS will be adversely impacted. Thus, if respondents answered "No" to these questions it means that it is not difficult for the internal audit function to obtain access to the organisation's data without the support from IT, and data analysis is performed with the use of commercial GAS packages such as ACL and IDEA rather than Microsoft Excel; it should therefore contribute positively to the maturity level in the use of GAS from a technology perspective. Therefore, the scoring for questions 5.1 and 5.6 were as follows:

- Yes scored 0.
- No scored 1.

For the ordinal variable (question 5.9.1), where the respondents indicated the frequency of their use of data visualization tools for reporting purposes, the scoring was allocated as follows:

- Never scored 0.
- Rarely scored 1.
- Sometimes scored 2.
- Often scored 3.
- Always scored 4.

It should thus be noted that the scoring allocation for question (5.9.1) resulted in a maximum score value of 4 points (due to the nature of the question) compared to the other questions where a maximum score of 1 could be allocated. For this reason, the scoring allocation for question 5.9.1 was adjusted in order to ensure that each question contributed equally (i.e., a maximum score value of 1) to the total maximum score for this aspect. This was achieved by dividing each of the scores for this question by 4, which resulted in this question also only contributing a maximum of 1 point.

For question 6.1, the more satisfied the respondents are with the current degree to which GAS has been implemented by their internal audit functions, the higher their maturity levels should be in the use of GAS from a technology perspective. The scoring for question 6.1 was therefore allocated as follows:

- "Significantly dissatisfied: requires major improvement" is coded as 1.
- "Dissatisfied: requires improvement" is coded as 2.
- "Neither satisfied or dissatisfied: functional but not yet optimal" is coded as 3.
- "Reasonably satisfied: however, some improvement may be required" is coded as 4.
- "Very satisfied: no improvement required" is coded as 5.

It should be noted that the scoring allocation for question 6.1 resulted in a maximum score value of 5 points (due to the nature of the question) compared to the other questions where a maximum score of 1 could be allocated. For this reason, the scoring for question 6.1 was adjusted in order to ensure that each question contributed equally (i.e., a maximum score value of 1) to the total maximum score for this aspect. This was achieved by dividing response scores for this question by 5, which resulted in this question also only contributing a maximum of 1 point.

The results of the scoring for the previously mentioned questions are reflected in Table 4.6. The table also includes the total score for each bank, which is listed at the bottom of the table. This score is then presented as a percentage of the maximum possible score a bank could have achieved for this aspect. This percentage represents the score used to allocate the banks a maturity level which reflects their use of GAS from a technology perspective in their internal audit function.

Table 4.6: Maturity scoring with respect to the technology aspect for each bank

QUESTION NUMBER	BANK 1	BANK 2	BANK 3	BANK 4	BANK 5	BANK 6	BANK 7	BANK 8	BANK 9	Maximum score per question
Q5.1	0	1	1	0	0	0	0	0	0	1
Q5.2	0	1	1	1	0	0	0	0	1	1
Q5.3	0	0	0	1	0	0	0	0	1	1
Q5.4	0	1	1	0	0	1	1	0	0	1
Q5.5	0	0	1	0	0	0	0	0	1	1
Q5.6	0	0	1	1	0	1	1	1	0	1
Q2.2.1	1	0	1	1	0	1	1	1	1	1
Q5.7	0	1	0	1	0	1	0	0	1	1
Q5.8	0	1	0	1	0	0	0	0	1	1
Q5.9.1	0,25	0,75	0,5	0,5	0,5	0	0,25	0	0,25	1
Q6.1	0,4	0,4	0,8	0,6	0,4	0,4	0,6	0,4	0,4	1
Total score	**1,7**	**6,2**	**7,3**	**7,1**	**0,9**	**4,4**	**3,9**	**2,4**	**6,7**	**11**
Value as percentage of maximum score	**15%**	**56%**	**66%**	**65%**	**8%**	**40%**	**35%**	**22%**	**60%**	**100%**

The mean and the standard deviation were calculated for the total scores [mean – 4.5; standard deviation - 2.3]. Then the ranges (expressed as a percentage of the maximum possible score) to which the maturity levels were allocated are as follows:

- If a bank's total score (expressed as a percentage of the maximum possible score) was 0, a maturity level of 0 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 1 and less than 20, a maturity level of 1 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) was between 20 and less than 41, a maturity level of 2 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 41 and less than 62, a maturity level of 3 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) fell between 62 and less than 83, a maturity level of 4 was allocated.
- If a bank's total score (expressed as a percentage of the maximum possible score) was 83 and more a maturity level of 5 was allocated.

Figure 4.10 illustrates the distribution of the different levels of maturity achieved by each bank with regard to the aspect of technology.

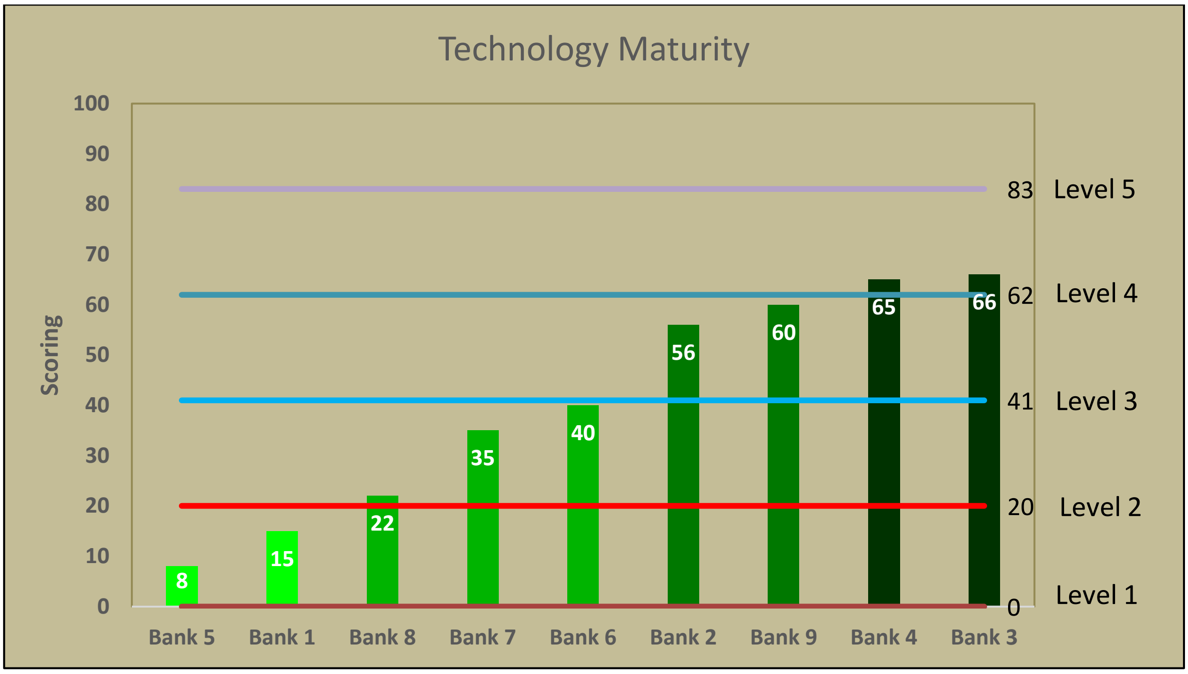


Figure 4.10: Maturity assessment: Technology

Reviewing the results from Figure 4.10 it is clear that the technology platform the banks have in place that should enable the performance of data analytics with the use of GAS is also not yet optimal in a majority of the banks' internal audit functions. To summarise, 55.6% of the respondents (banks 1, 5, 6, 7 and 8) fell in a low level of maturity (levels 1 and 2) with regards to the aspect of technology. Two respondents (22.2% - banks 2 and 9) achieved a medium level of maturity (level 3) for this aspect. Only two respondents (22.2% - banks 3 and 4) displayed a high level of maturity (level 4) with regard to the aspect of technology. Refer to section 4.5.4 for a summary of the overall maturity allocation per aspect for each bank.

4.5.4 Overall maturity assessment

In order to calculate the overall maturity level of each bank, with respect to their use of GAS to conduct data analytics for tests of controls purposes (as was indicated in section 3.7), the three aspects (people, processes and technology) should collectively contribute to generating the overall maturity assessment. In order to achieve this, each of the three aspects (people, processes and technology) was equally weighted. This meant that, because there were differences in the number of questions addressing each of these aspects (for example, as the process aspect had more questions than the others, it could have had a much higher influence on the assessment than either the technology or people aspects), a simple arithmetic average was calculated for each bank, using the following formula:

$$(P + PR + T)/3$$

Where P = total score for people for a specific bank

PR = total score for process for a specific bank

T = total score for technology for a specific bank

Figure 4.11 illustrates the distribution of the overall maturity levels that were achieved after having applied the above mentioned formula to the data for each bank with regard to the three aspects, namely people, processes and technology. This overall maturity scoring is graphically presented in Figure 4.12.

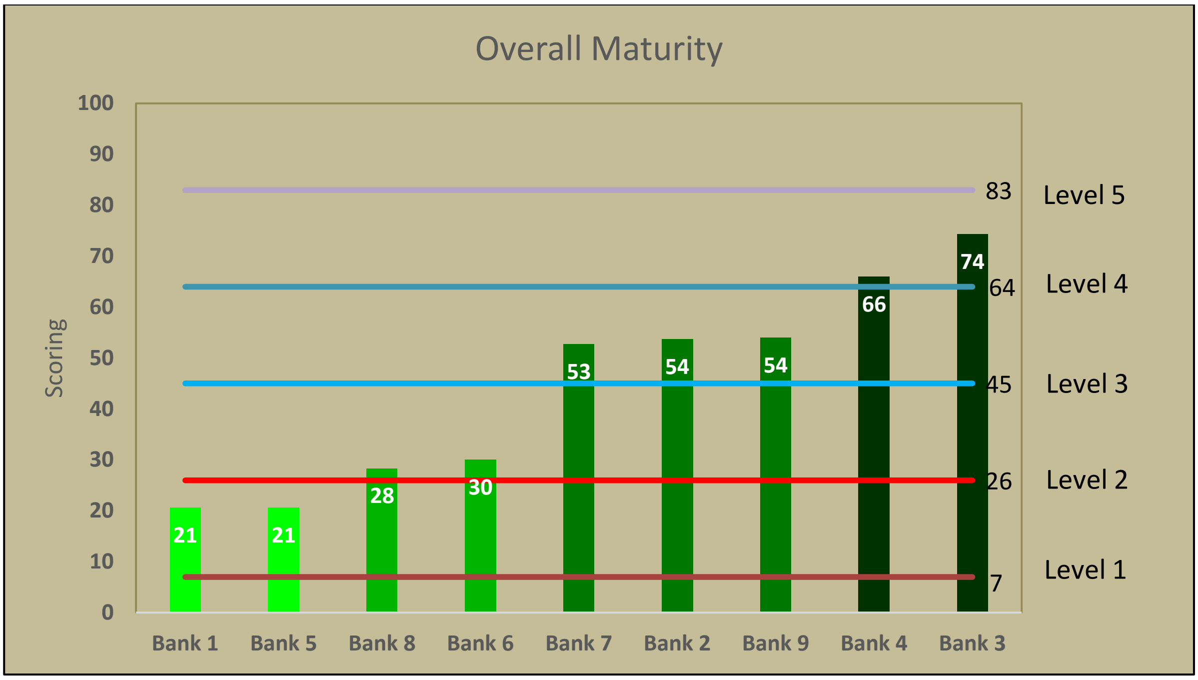


Figure 4.11: Overall maturity scoring

The mean and standard deviations were calculated for the overall maturity scores mentioned [mean – 44.4; standard deviation – 18.8]. The ranges to which the maturity levels were allocated are as follows:

- If the bank's overall total fell between 0 and less than 7, a maturity level of 0 was allocated.
- If the bank's overall total fell between 7 and less than 26, a maturity level of 1 was allocated.
- If the bank's overall total fell between 26 and less than 45, a maturity level of 2 was allocated.
- If the bank's overall total fell between 45 and less than 64, a maturity level of 3 was allocated.
- If the bank's overall total fell between 64 and less than 83, a maturity level of 4 was allocated.
- If the bank's overall total was 83 and more, a maturity level of 5 was allocated.

Table 4.7 summarises the maturity levels achieved by each bank for each of the people, process and technology aspects.

Table 4.7: Maturity levels of banks per aspect

	Low Maturity		Medium Maturity	High Maturity	
Overall per aspect	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
People	Bank 1 Bank 6	Bank 5 Bank 8	Bank 2 Bank 7 Bank 9	Bank 3 Bank 4	
Process	Bank 5	Bank 1 Bank 2 Bank 6 Bank 8 Bank 9	Bank 4 Bank 7		Bank 3
Technology	Bank 1 Bank 5	Bank 6 Bank 7 Bank 8	Bank 2 Bank 9	Bank 3 Bank 4	

The results displayed in Table 4.7 were then used to calculate the overall maturity assessment achieved, and this is presented in Table 4.8.

Table 4.8: Overall maturity assessment per bank

	Low Maturity		Medium Maturity	High Maturity	
Overall for all aspects	**Level 1**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
People **Process** **Technology**	Bank 1 Bank 5	Bank 6 Bank 8	Bank 2 Bank 7 Bank 9	Bank 3 Bank 4	

Presenting the information from Tables 4.7 and 4.8 graphically in Figure 4.12 illustrates the overall maturity levels achieved in the use of GAS for each of the three aspects (technology, processes and people) by each bank, using the scoring methods and allocations discussed in sections 4.5.1 – 4.5.3.

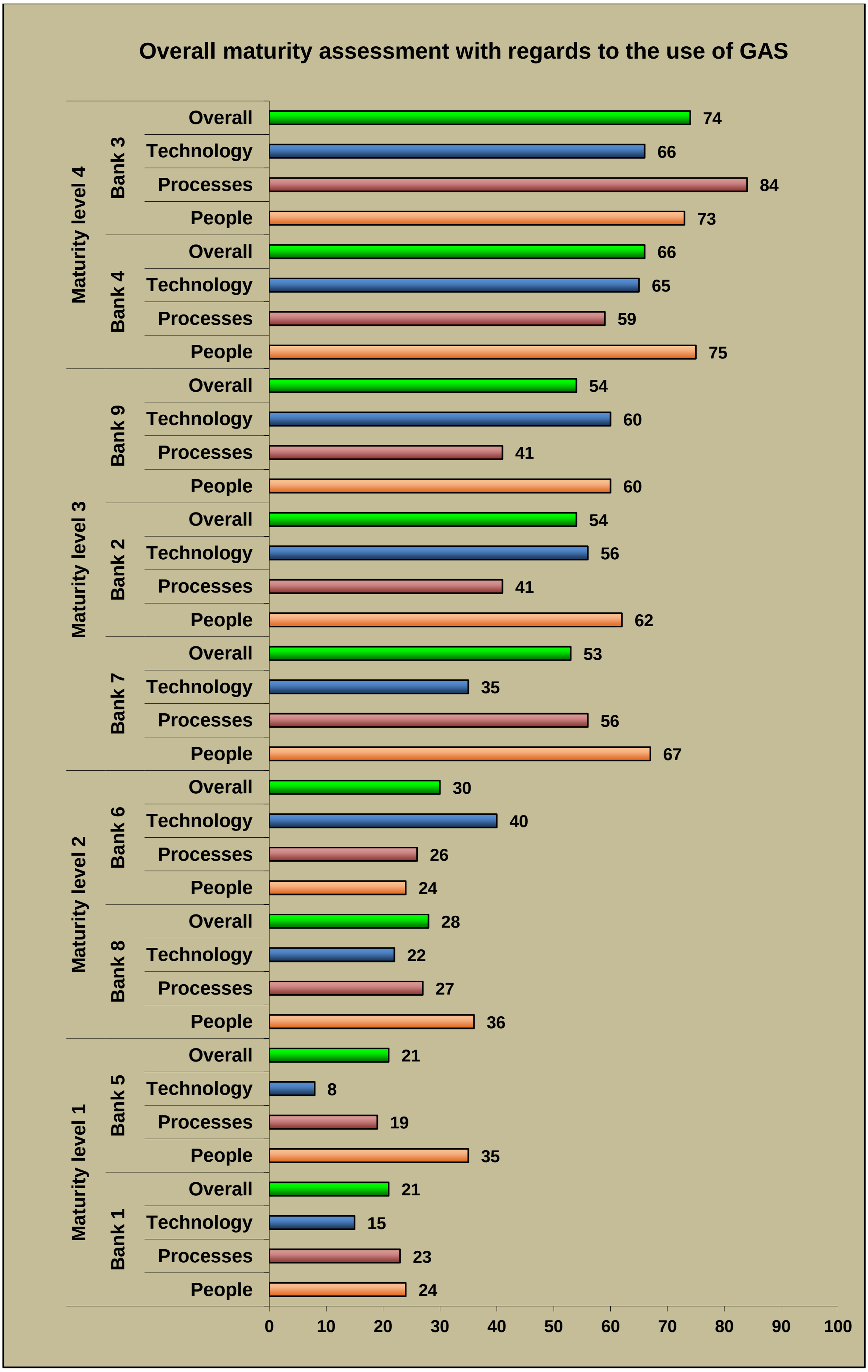


Figure 4.12: Overall maturity assessment

4.6 CONCLUSION

In this chapter the findings and technical analysis of the empirical data gathered was discussed. The majority of the respondents currently do use GAS for data analytics purposes in obtaining audit evidence for conducting tests of controls. The most popular GAS tool currently in use is ACL. Although the majority of respondents are currently using GAS (in this case ACL), the frequency of its use in conducting internal audit engagements is still at a low level, with 88.9% of the respondents subscribing to the belief that GAS can still be utilised more frequently than it is at present within their respective internal audit functions.

A factor contributing to the relatively low frequency of use of GAS could be the low skillset of internal auditors in the use of GAS. The overall skillset of individual internal auditors in the use of GAS (indicated as limited, basic or advanced) needs to be improved. The majority (66.7%) of the respondents whose internal audit staff have only <u>limited</u> skills in the use of GAS are between 21% and 60% of the respective internal audit teams. 66.7% of the respondents indicated that between 21% and 40% of their internal audit staff have <u>basic</u> skills in the use of GAS, while 66.7% of the respondents also indicated that less than or equal to 20% of their internal audit staff have <u>advanced</u> skills in the use of GAS. However, despite the low quality of the skillset possessed by individual internal auditors, it is nevertheless encouraging to note that 55.6% of the respondents also have separate <u>data analytics teams</u> that exhibit advanced skills in the use of GAS. Furthermore, 77.8% of the respondents also have individuals with specialist skills such as Data Specialists (who have a sufficiently detailed understanding of IT infrastructure and data sources to be able to access the data), <u>and/or</u> ERP systems specialists (who have expert knowledge of ERP systems such as SAP and/or Oracle) who are able to <u>support and enable the internal audit function</u> to conduct data analytics using GAS.

A further point of encouragement is that the CAEs have strategies in place to increase the maturity of the use of GAS within their respective internal audit functions: 88.9% of the respondents indicated that they have the necessary buy-in and support from their audit management for them to use GAS as part of their internal audit methodologies. In addition, 55.6% of the respondents also indicated that their banks' internal audit functions have formalised and implemented procedures, standards, and documentation, and offer training and guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement. The presence of these strategies should pave the way for these internal audit functions to increase the maturity of the use of GAS in the locally controlled segment of the South African banking industry.

With reference to the notion of implementation of a risk based internal audit approach (as was discussed in section 2.2.3), it was identified that the use of GAS for risk based annual audit planning purposes, as well as for risk based engagement planning purposes, was the exception rather than the norm. The primary tasks for which internal audit functions use GAS (cited as *often to always*) in a separate internal audit engagement are:

- to identify transactions with specific characteristics or control criteria for tests of control purposes;
- to conduct full population analyses;
- to identify account balances over a certain amount;
- to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events; and
- to obtain audit evidence about the effectiveness of controls.

GAS was predominantly used to generate descriptive analytics (i.e., it is predominantly used to answer questions such as: "what happened?" - a historical or hindsight perspective). The use of GAS for diagnostic and predictive analytics was limited, thus justifying the assessed lower level of maturity in the use of GAS by those internal audit functions. Contributing factors that also adversely impacted on the maturity of the use of GAS included the fact that the majority of respondents found it difficult to obtain access to the organisational data for data analytical purposes, without support from IT. The overall dissatisfaction with the current degree to which GAS has been implemented by their respective internal audit functions (expressed by 66.7% of respondents) also justifies the overall lower level of maturity in the use of GAS by those internal audit functions.

The overall assessment of the maturity of the use of GAS was based on the three aspects (people, processes and technology) which contributed equally to the overall assessment of the maturity of use of GAS by the internal audit functions in the locally controlled South African banking industry.

The overall assessment of the maturity of the **people** aspect revealed that 44.4% of the respondents demonstrated a low level of maturity (levels 1 and 2), while another 33.3% of the respondents demonstrated a medium level of maturity (level 3) for this aspect. There were only two respondents that achieved a high level of maturity (level 4) for the aspect of people.

The overall assessment of the maturity of the **process** aspect revealed that 66.7% of the respondents demonstrated a low level of maturity (levels 1 and 2), while another 22.2% of the respondents demonstrated a medium level of maturity (level 3) for this aspect. There was only one respondent that displayed a high level of maturity (level 5) for the aspect of process.

The overall assessment of the maturity of the **technology** aspect revealed that 55.6% of the respondents demonstrated a low level of maturity (levels 1 and 2), while two respondents demonstrated a medium level of maturity (level 3). Another two respondents demonstrated a high level of maturity (level 4) with regard to the aspect of technology.

The overall assessment of maturity of the use of GAS (i.e., the sum of the assessments of maturity of the people, process and technology aspects) revealed that 44.4% of the respondents demonstrated a low level of maturity (level 1 and 2), while 33.3% demonstrated a medium level of maturity (level 3). Only 22.2% demonstrated a high level of maturity (level 4).

All in all, no respondents achieved an overall maturity rating of level 0, which is an indication that the internal audit functions of the locally controlled banking industry of South Africa has at least started on the maturity continuum in their use of GAS for tests of controls purposes. At the other end of the spectrum, no respondents received an overall maturity rating of level 5 either, which is an indication that the maturity of the use of GAS by the locally controlled internal audit functions of the South African banking industry has not yet been optimised. The highest overall level of maturity achieved was level 4, and only two respondents achieved this level. This indicates that the use of GAS by these banks' internal audit functions is at a higher level of maturity than in the remaining banks surveyed. It should however be noted (as was revealed by the results recorded in sections 4.4.2 – 4.4.6) that not a single respondent has reached a level in any of the three aspects, where there is no longer any room for improvement (even if an overall maturity rating of 5 was achieved).

Out of the findings presented in this chapter, a concluding overview of the use of GAS by internal auditors in the South African banking industry is presented in Chapter 5. The value of this study, as well as opportunities for future research, is also discussed.

CHAPTER 5
SUMMARY AND CONCLUSION

5.1 INTRODUCTION

The modern internal audit function is under constant pressure (as discussed in sections 2.2.5 and 3.6) to deliver greater value and deeper insight to an organisation or bank regarding the effectiveness of their governance, risk management, and controls, usually without the luxury of an increased staff compliment or budget. In other words, the modern internal audit function is expected to dedicate less time to conducting internal audit engagements while still delivering more value and providing greater assurance to its various stakeholders. This has a direct impact on the internal audit function's resource requirements and deployments so that it can still produce value adding audits and successfully complete all engagements in accordance with the annual audit plan as approved by the board of directors or its audit committee (also refer to section 2.2.3). In addition, the Standards (Standards 2020 and 2030) emphasise the importance of adequate resources in order to achieve the annual audit plan. The requirements of these two Standards are set out below:

Standard 2020 – *Communication and Approval* – *"The chief audit executive must communicate the internal audit activity's plans and resource requirements, including significant interim changes, to senior management and the board for review and approval.* ***The chief audit executive must also communicate the impact of resource limitations*** [own emphasis]*"* (IIA, 2012a:10).

Standard 2030 – *Resource Management* – *"The chief audit executive must ensure that internal audit resources are appropriate, sufficient, and effectively deployed to achieve the approved plan"* (IIA, 2012a:10).

A lack of adequate resources could adversely impact the quality of the internal audit engagements as well as the value to be derived from it. These Standards thus emphasise how important it is for internal audit functions to take full advantage of the resources (including modern technology-based resources) that are available to them in an effort to alleviate the pressures on their staff compliments as they strive to respond to and address their various stakeholders' expectations. The adoption of technology-based tools such as GAS should enable internal audit functions to conduct data analytics, to dive deeper into their organisations' data, and to cover a broader audit and/or risk universe that in turn should provide greater insight and foresight into emerging risks and potential fraudulent issues facing the organisations' control environments. In the words of Carly Fiorina, *"The goal is to turn data into information, and information into insight"* (cited in Shander, 2016).

The leading internal audit functions will be those that continue to be innovative in the conduct of their duties: for example, they will utilise technology-enabled techniques to their advantage, thus ensuring that they keep pace with the ever-evolving organisational landscape. The already significant and increasing daily volumes of transactions processed by a bank make the use of GAS an essential tool, particularly as it's use enables the internal auditor to select audit evidence appropriate to the testing of the effectiveness of a bank's internal controls, risk management and governance processes.

The rest of this chapter consists of brief overviews of each of the previous chapters. Thus, section 5.2 summarises the literature review while section 5.3 provides an overview of the use of GAS by internal auditors in the locally controlled segment of South Africa's banking industry. This information was obtained through empirical research and its structure and analysis is detailed in Chapter 4. Section 5.3 also then revisits the main findings and emphasises essential recommendations emerging therefrom. Section 5.4 briefly discusses the study's limitations and the opportunities these present for future research. Section 5.5 presents concluding remarks.

5.2 OVERVIEW OF THE LITERATURE REVIEW AND THE KEY OBSERVATIONS ARISING THEREFROM

Internal audit is a dynamic and global profession, and during its 75 years of its professional existence (it was established in 1941), it was inevitable that it would have to adapt to the changing needs and times in order to keep pace especially with the technological developments that now drive all aspects of commerce and industry.

The evolvement of the IIA's statement of responsibilities records the changing definition of internal audit (see Table 2.1). Internal audit started off playing a limited role of mainly compliance and clerical accounting work, which has now been transformed into an independent advisory function, reporting to the highest levels of the entity, on issues of fundamental importance to the sustainability of the organisation. The modern internal audit function has an open invitation to address the audit committee, and in the case of South African banks, is heavily relied upon by the Supervisor, the banks' boards of directors, senior management, and other stakeholders (as mentioned in section 1.1). This reliance on the internal audit function confirms its critical role as one of the three lines of defence (i.e., as one of the independent assurance providers) in an organisation with regard to good governance in an organisation (refer to section 2.1 and 2.6.1). In addition, one of the rapidly escalating and key expectations that the various stakeholders of an internal audit function have, amongst others, is that it provides organisations with deeper insights regarding the ever evolving risk landscape so as to assist these organisations to achieve their various business objectives (also refer to section 2.2.5).

The first chapter, in providing a general introduction to the study, outlined the importance and impact of a sustainable banking industry in a country's economy. The systemic nature of risk as a result of increasing globalisation of businesses that now span multiple jurisdictions and countries, was also made evident by the corporate banking collapses that have occurred within the international and local banking industry over the last 40 years (as recorded in section 1.1). An overview of the internal auditing profession and its important role as an assurance provider in the South African banking industry was outlined in Chapter 2. Chapter 3 then provided an overview of technology-based tools available to and used by internal audit functions, with emphasis on the use of CAATs and specifically GAS, as applied to the tests of controls.

A few of the most important observations emerging from the literature review are:

- The use of a risk based audit approach by internal audit has been emphasised in authoritative literature including the King III and King IV Reports, and professional standard setting bodies such as the Basel Committee and the IIA (this was discussed in section 2.2.3).

- The increased use of technology by organisations has necessitated that internal audit functions relook at their current audit methodologies, and specifically at the utilisation of technology-enabled tools and techniques, in the conduct of their duties. In other words, internal audit functions have had to transform in an effort to remain current and to be able to deliver on its statement of responsibilities in an effective and efficient manner. Furthermore, the Standards encourage internal audit functions to incorporate the use of technology-based tools in the execution of their duties (refer to section 1.1).
- Additional factors that have contributed to revolutionising the role of internal audit are the “pressures” imposed on it by its various stakeholders. To reiterate, some of the pressures experienced by internal audit functions (as discussed in sections 2.2.5 and 3.6) are:
  - they are expected to do more with less (i.e., perform lean audits as a result of cost cuttings and pressure on organisations’ audit budgets);
  - they are required to provide the audit committee, senior management and other stakeholders with timely audit results that contain deeper insights and value;
  - they are expected to provide assurance on a much broader organisational risk and control landscape;
  - they are required to play a more prominent role with regard to compliance and risk management;
  - they are viewed as the trusted advisors of members of senior management and are expected to fulfil a more proactive role regarding the identification of risks and controls; and
  - they need to conduct their day-to-day activities in a control environment that is dominated by technology and big data.
- Their efforts to respond to these pressures, most often imposed on internal audit functions by their various stakeholders, have led to a general increase in the adoption and use of technology-based tools, particularly in the period 2006 up to 2015 (refer to section 2.2.5). Although an increase in the majority of technology-based tools has been noted, their frequency of use is still at a relatively low level, and internal audit functions globally will have to increase the tempo at which they

embrace technology in the conduct of their duties in order to avoid becoming irrelevant in this era that is increasingly dominated by the use of information technology and big data.

- The development of technology and the use of and existence of big data has not only had a significant impact on organisations' (and particularly on banks') operating business models (refer to section 3.1), but has equally impacted the internal audit function with specific reference to the nature of audit evidence and the methods now needing to obtain that audit evidence (as was discussed in section 3.2).
- The current level of maturity of the use of CAATs and GAS by internal audit functions is still low (as discussed in section 3.1). To repeat, a number of internal audit studies (refer to section 3.5) have explored the use of technology-based tools by internal audit functions in an effort to establish whether these internal audit functions perform data analytics on the vast amounts of data that reside within the various control environments in which they must conduct their duties. It appears from these various internal audit studies that the extensive use of technology-based tools by any one internal audit function is the exception rather than the norm.
- There are however various contributing factors that play an important role in internal audit functions' decision-making as to whether they should adopt the use of technology-enabled tools such as GAS, or rather to reject their implementation. Those internal audit functions that have decided to make use of GAS consistently cite the advantage of "enhanced audit efficiency", amongst others, as a factor favouring their adopting its use (refer to section 3.5.1). On the other side of the argument, those functions that have decided not to implement GAS consistently cite the issues of access, availability, accuracy, completeness and integrity of the data they would have been required to audit, amongst others, as a top concern that has resulted in them not to integrate the use of GAS and data analytics into their audit methodologies (refer to section 3.5.1).
- As far as could be determined from the authoritative internal auditing literature, seven existing data analytics maturity frameworks exist that have been specifically developed for internal audit functions (refer to section 1.1). One of these maturity frameworks has four levels of maturity, while five have five levels of maturity. The

final data analytics framework has six levels of maturity (refer to section 1.4.4 and 3.7). As highlighted in section 1.4.4, at the very basic or introductory level (i.e., levels 0 – 2) the capabilities of internal audit functions to use GAS to conduct data analysis are either non-existent or are limited, and as a result the frequency of use of GAS is also low. On the other hand, levels of maturity at the other end of the continuum (i.e., levels 4 – 5) are used to designate internal audit functions that are well versed in the use of GAS and data analytics, in fact to such an extent that continuous auditing and continuous monitoring capabilities are operational. Over the 10 year period 2006 to 2015 a growth of 7% has been noted in the implementation and use of continuous auditing by internal audit functions around the globe (refer to section 3.6). This relatively slow growth confirms that internal audit functions operating at this level of maturity are still in the minority and that there is still ample room for improvement. It is also important to note that in assessing the overall level of maturity of the use of GAS or data analytics by an internal audit function the sum of the assessments of the maturities of the three component factors, namely, people, process and technology, should be considered (refer to section 3.7).

The next section provides an overview of the results of the empirical study of the maturity levels of internal audit functions of the locally controlled South African banking industry with respect to their adoption of GAS. It also offers recommendations for improvements, and identifies the contributions the study makes to the advancement of research.

5.3 OVERVIEW OF THE EMPIRICAL RESEARCH, PRESENTATION OF IMPORTANT RECOMMENDATIONS AND IDENTIFICATION OF CONTRIBUTIONS MADE BY THE STUDY

The literature review (as highlighted in section 5.2) informed and was followed by an empirical research survey. The empirical research (refer to section 1.4.1) was conducted to collect evidence that would describe and explain the use of GAS by internal audit functions when performing tests of controls in the South African banking industry. The empirical results emerging from this research led to the identification of the current levels of maturity of the use of GAS by the responding internal audit functions of South African controlled banks.

These findings may be useful to professional bodies (such as the IIA and ISACA) that develop and publish standards and/or guidance pertaining to the use of technology-based tools (specifically CAATs and GAS) by internal auditors and information systems auditors. Thus, ISACA may use this study's findings as a useful reference point from which to expand their guidance on (and thus promote) the use of CAATs (performance guidance, *Evidence* (ISACA, 2014:110)) (CAATs which include GAS), so as to formally include the internal audit sphere. The IIA in particular, may use this study's findings to formulate definitive guidelines regarding the use of GAS by internal auditors. In addition, the research findings may also enable the heads of the individual internal audit functions of the locally controlled banks to benchmark their use of GAS against their peers. They should then be able to assess the degree to which their practices conform to the industry's norm, and then decide whether their use of GAS and performance of data analytics should be revisited.

The results of this study have provided a deeper understanding of the current levels of maturity of the use of GAS by the internal auditors employed by locally controlled South African banks. It further provides useful insights for internal audit practitioners, GAS vendors, professional auditing bodies such as the IIA and ISACA, academia and researchers to expand upon. This study thus not only contributes to the existing body of knowledge on the use of GAS by internal audit functions from a locally controlled South African banking perspective, but will also add an international dimension shortly, as this study is already being replicated across the Federal Government of Canada's internal audit functions, as well as within the internal audit functions of the banking industry in Portugal.

A few of the most important findings identified during the empirical analysis are briefly discussed next:

- The majority of the respondents do currently use GAS for data analytics purposes in obtaining audit evidence for conducting tests of controls. The most popular GAS tool currently in use is ACL.

- The frequency of use of GAS in conducting internal audit engagements, however, is still at a low level in that 88.9% of the respondents believe GAS can still be utilised “more frequently” than it is at present within their respective internal audit functions.
- The overall skillset of individual internal auditors in the use of GAS needs to be improved.
- 55.6% of the respondents also have a separate data analytics team that exhibit advanced skills in the use of GAS. Furthermore, 77.8% of the respondents also have ready access to individuals with specialist skills such as Data Specialists and/or ERP systems specialists who are able to support and enable the internal audit function’s efforts to conduct data analytics with the use of GAS.
- 88.9% of the respondents have the necessary buy-in and support from their audit management for the use of GAS as part of their internal audit methodology.
- 55.6% of the respondents indicated that their bank’s internal audit function has formalised and implemented procedures, standards, and documentation, and that it offers training sessions that provide guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement. In contrast to this, 44.4% of the respondents also indicated that their internal audit function’s use of GAS is still largely an informal arrangement: i.e., it is up to the individual internal auditor to decide whether or not to make use of GAS.
- The frequency of the use of GAS for risk based annual audit planning purposes, as well as for risk based engagement planning purposes, is the exception rather than the norm.
- With reference to the second research objective defined for this study (refer to section 1.2) the main (i.e., the top five) purposes for which the internal audit functions make use of GAS *often to always*) during separate internal audit engagements are:
    - to identify transactions with specific characteristics or control criteria for tests of control purposes;
    - to conduct full population analysis;
    - to identify account balances over a certain amount;
    - to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events; and

  - to obtain audit evidence about control effectiveness.
- Only 22.2% of the respondents indicated that their banks have custom-built automated scripting and testing in place that is running according to a predefined schedule (i.e., continuous auditing). The implementation and use of continuous auditing is therefore not at a mature level in a majority (77.8%) of the internal audit functions in South Africa’s locally controlled banking industry. In addition, only 22.2% of the respondents indicated that their banks also have real-time data monitoring with system workflow processes in place through which the control owners in the respective business units in the banks are notified of exceptions, and are able to respond to them (i.e., continuous monitoring).
- Only 11.1% of the respondents indicated that their banks have developed and tested comprehensive suites of tests, and that these are available in a central, controlled environment for use by their internal audit staff.
- The majority of the respondents (77.8%) indicated that it is difficult for the internal audit function to obtain access to the organisational data without support from IT.
- The main form of data analytics performed with the use of GAS was predominantly focused on delivering descriptive analytics.
- 66.7% of the respondents indicated that they were dissatisfied with the current degree to which GAS has been implemented by their internal audit functions.
- The overall maturity assessment (refer to the primary research objective as defined in section 1.2) (i.e., the sum of the assessments of people, process and technology) revealed that 44.4% of the respondents only managed to achieve a low level of maturity (levels 1 and 2); 33.3% achieved a medium level of maturity (level 3), and only 22.2% achieved a high maturity rating of level 4. (None of the respondents achieved a maturity rating of level 5.) Consequently, the maturity of the use of GAS by the internal auditors employed by locally controlled South African banks is still lower than had been anticipated, given the rapidly developing state of today’s technology-driven business environment.

In light of the current level of maturity of the use of GAS by the internal audit functions of the locally controlled South African banks, and the findings that emerged during the empirical analysis (refer to Chapter 4), the following recommendations are offered (refer to the third research objective as defined in section 1.2):

- At the outset, an internal audit function needs to have an in-depth understanding of their bank's objectives, risks and controls. This could be achieved by identifying "what matters the most" to their respective banks with reference to the set business objectives to be achieved. A risk prioritisation exercise can then be conducted with regard to those risks that threaten the achievement of those objectives. This should be useful in identifying those areas or controls that could mitigate the various risks that threaten the achievement of those objectives. A decision can then be made to identify those areas in the bank that can be analysed or audited using means other than the traditional means of conducting internal audit engagements, alternatives such as the use of data analytics, for example, through the use of a GAS tool for tests of controls purposes.
- Those internal audit functions that achieved a lower overall level of maturity in the use of GAS should not be discouraged but should realise that the strategy to build and implement technology-based tools (such as the use of GAS for data analytics purposes) into their respective internal audit methodologies does take time. In other words, the strategy should be to start small and to grow the data analytics initiative consistently over time. It is however important that the CAE keeps the data analytics strategy as a key priority on his/her agenda in order to ensure it receives the necessary attention so that gradually (i.e., using a phased approach) the data analytics strategy within his/her internal audit function can become fully operational. The individual CAEs should actively drive the data analytics strategy so that all key stakeholders within the bank eventually support it. In other words, the CAE should fulfil the role of a "change agent" by creating an awareness of the benefits arising from the use of GAS and data analytics, especially within the context of the internal audit function's purpose as one of the key assurance providers in an organisation. This pressure on the CAEs should be alleviated if they are able to rely on their audit management team for support in this regard, as most of the respondents indicated that they do have buy-in and support from their audit management.
- It could prove useful to the individual internal audit functions to conduct periodic self-assessments to determine their current data analytical capabilities using an established internal audit data analytics maturity framework. The results of such assessments could provide insight regarding the internal audit function's current

capabilities, and enable comparison with previous assessments in order to provide useful information identifying areas that have improved or that are still in need of improvement in its data analytics strategy. This self-assessment should be aimed at assessing all three aspects, namely, people, process and technology. All three of these aspects should receive equal priority as they are interdependent, and this will increase the likelihood of a successful and sustainable data analytics strategy. The results of this study have identified areas for improvement in all of these aspects for each of the participating South African controlled banks. The CAEs should therefore also find the results of this study useful in identifying those areas that warrant emphasis on their individual data analytics journeys.

- The low level of skills displayed by the individual internal auditors could be addressed through internal on-the-job training, or through specialist external training. Most of the internal audit functions indicated that they do have dedicated data analytics teams consisting of individuals with specialist knowledge in the use of data analytics. Internal audit functions should therefore first capitalise on their internal skillsets by hosting internal training workshops in order to improve the current skillset of individual internal auditors with respect to the use of GAS and data analytics. In addition, the inclusion of the use of GAS as one of the Key Performance Areas for internal auditors' performance evaluations, and by offering higher levels of remuneration for those internal audit staff members with such specialist data analytics skills, should encourage internal audit staff to improve their current skills in the use of GAS and data analytics.
- Those internal audit functions where the use of GAS is an informal arrangement, (where it is up to the individual internal auditor to decide whether or not to make use of GAS) could address this situation through the introduction of formalised policies which could make the use of GAS mandatory.
- The limited use of continuous auditing could also be overcome by introducing the continuous auditing initiative gradually into certain areas of the bank. For example, the individual CAEs might start by introducing continuous auditing only in a specific area, such as logical access controls. Key lessons learned can then be taken from this initial initiative and used to improve the continuous auditing effort in that area until it is functioning optimally. The continuous auditing strategy can then be rolled out to other areas of the bank, until the continuous auditing strategy is

fully embedded in all areas of the bank. A similar strategy can be followed in an effort to improve the continuous monitoring drive within these banks.

- The issues surrounding gaining access to the organisational data without support from IT could possibly be addressed through active engagement or communication between the internal audit function and the IT department in an effort to strengthen the relationship between these parties. The CAE should actively engage with the Chief Information Officer in order to provide senior IT management with an overview of the important role and purpose of the internal audit function within the bank. The CAEs could then potentially establish a data access protocol with the IT department so as to obtain data for audit and analytical purposes without hindrance to either party. It is important to gain the support of IT and specific effort should thus be made so that both IT and internal audit understand the data issues from the other's side, and thus enable internal audit to gain access to the desired data.
- Lastly, when the CAE builds the data analytics plan, it is critical to set achievable goals that should align with the internal audit function's budget and skills, and to acknowledge the investment requirement, should the use of GAS be expanded.

The next section provides an overview of the limitations of the study and also presents opportunities for future research.

5.4 LIMITATIONS OF THE STUDY AND OPPORTUNITIES FOR FUTURE RESEARCH

It should be born in mind that a single study cannot explore "everything" related to the subject matter, and that a study is conducted within the boundaries imposed by the research objectives and the associated research population, amongst others. In addition, a study is also conducted within specific time and financial constraints which may also restrict the extent and scope of such a study. The term "limitation" should therefore not be viewed in a negative light. It is not a limitation related to the quality of the study conducted, but rather a limitation on the coverage achieved with regard to the respective research topic and as set out by the research objectives of a study.

The empirical results of this study (as set out in Chapter 4) should therefore be interpreted in the context of the following limitations:

- CAATs include a broad definition (i.e. it includes many different types of technology-driven and technology-dependent tools), as was indicated in sections 3.4 and 3.4.2. This study focused specifically on the use of GAS (as mentioned in section 1.2) as it is one of the most popular and frequently used types of CAATs, by internal audit functions when conducting tests of controls. This study therefore did not gather information about the use of any other types of CAATs from the research respondents.
- Furthermore, this study focused on the use of GAS by *internal auditors* in the locally controlled South African banking industry. This study therefore excluded the use of GAS employed by *external auditors* in the locally controlled South African banking industry.
- The interpretation of the data and the use of the ranges (i.e., the cut-off points between the various maturity levels) in conducting the maturity assessment (refer to section 4.5) with the use of the data analytics maturity framework as defined in Annexure B is limited to the context of the internal audit functions in the locally controlled banking industry of South Africa.
- An additional limitation is that the research addresses only the internal auditor's performance of *tests of controls* using GAS, and did not attempt to explore the use of GAS when performing tests of details or any other form of investigation.
- The research population was restricted to the locally controlled banking industry for the reasons discussed in section 1.4.6. This limitation was imposed to facilitate the gathering of readily comparable data, and this was achieved because these banks comply with a single statutory regime. In addition, their internal audit methodologies are locally developed and maintained, which makes this a truly South African based study. The empirical results of this study are therefore specifically applicable only to these banks.
- The empirical data was primarily collected through the use of a structured questionnaire. The respondent universe was the heads of the internal audit functions of the 10 locally controlled banks.

- This study did not explore specific operating divisions, business processes or departments within these banks (e.g., home loans, vehicle and asset finance, logical access or the trading desk, et cetera), that are also audited with the use of GAS.

Further research opportunities therefore exist in the preceding limitations, and these are briefly highlighted next:

- The research population in South Africa could be broadened to include foreign controlled banks that have representation in South Africa, and that are permitted to conduct the business of a bank in accordance with South Africa's Banks Act (South Africa, 2007b, sec.34(4)). A comparative study could then be conducted, drawing the results of this study into a comparison that would highlight the similarities and differences between the maturity of the use of GAS by locally and foreign controlled banks' internal audit functions.
- In addition, this study can also be replicated in other countries which could lead to additional insights arising from comparisons between local and international practices.
- The study could also be replicated in a different context: for example, it could focus on the internal audit functions of professional auditing firms in South Africa.
- The research methodology could be extended to gain insights from multiple case studies in a variety of industries, a longitudinal study, or the use of face-to-face interviews. These various approaches could provide deeper insights with regard to the adoption and maturity of the use of GAS by internal audit functions generally.
- The target audience could be deepened, to research the perceptions and understanding of the different levels of staff within the individual internal audit functions, from entry level internal auditors through to senior management.
- The study could also be extended to include each of the banks' respective external auditors, in order to obtain their perspectives regarding the effectiveness and appropriateness of the use of GAS employed by these banks' internal audit functions. Further insights could be obtained when assessing the degree to which these banks' external auditors' place reliance on the work of internal audit when they incorporate GAS into their internal audit methodologies. Section 2.4.2 made

reference to the study conducted by Malaescu and Sutton (2015:107), who found that external auditors tend to place more reliance on the work of internal audit when the internal audit function makes use of technology-enabled auditing (such as continuous auditing) in the performance of its duties.

- The study could also be replicated to explore the maturity of use of GAS employed by external auditors.
- A future study could also consider the maturity of use of GAS by regulatory role players: for example, the internal audit function of the Reserve Bank of South Africa.
- Another study could also determine which operating divisions, business processes or departments within an organisation or a bank is most frequently and comprehensively audited with the use of GAS, and why.
- The study could be further extended to include other entities in the financial services sector, such as short and long term insurance companies. These results could then be compared against the findings of this study.
- The maturity of the use of other types of CAATs in performing data analytics for internal auditing purposes could also be considered for a future study.
- A future set of studies could also explore the use of GAS by internal auditors as they relate to tests of details.

The next section contains concluding remarks regarding the current level of maturity of the use of GAS by internal audit functions and specifically within the locally controlled South African Banking industry.

5.5 CONCLUDING REMARKS

As revealed by the empirical results of this study (discussed in Chapter 4) and the results of various other authoritative internal audit studies (identified in section 3.5) it is clear that the overall use of technology based tools, and in particular the use of GAS, is still lower than expected, given the current dominance of technological-driven business practices generally, and especially within the banking industry which is now dominated by big data. This concurs with the observation made by Coderre (2015:40) (as mentioned in section 3.5.1) that, *"Study after study has shown that the* *data analytics capabilities of internal audit functions consistently fall below what is desired and even what is required."* The performance of internal audit engagements in banks should be a continuous process which takes place in an effort to provide their various stakeholders with assurance regarding the effectiveness of governance, risk management, and controls. With the pervading uncertainty in business, and the ever evolving nature of risk and its potential impact on organisations, it is expected that internal audit functions will increasingly be tasked with the responsibility for anticipating future risk events that may threaten the achievement of the organisation's or bank's objectives. All of this will have to occur within control environments that are increasingly dominated by the use of technology and big data. Accordingly, internal audit functions in the locally controlled South African banking industry will inevitably experience increased pressures (refer to sections 2.2.5 and 3.6) from their stakeholders to provide them with meaningful results and analyses of the effectiveness of their respective control environments, should this current low level of maturity of the use of GAS continue (refer to section 4.5).

Furthermore, the last decade has seen many headline reports of corporate scandals and corruption both locally and internationally, not least within the banking industry (refer to section 1.1). Therefore, the heads of internal audit departments will have to be proactive in their efforts to build internal audit functions for the future. In other words, internal audit functions that embrace the use of technology-enabled tools in their individual audit methodologies should reduce the risk of becoming obsolete and should continue to be able to provide their stakeholders with new and valuable insights. Not only are they tasked with a responsibility to ensure that their internal audit functions continuously and consistently deliver on their mandates in an effective and efficient manner, but they also need to take up their leadership responsibilities and grow their internal audit functions to a level of maturity that sees the integration of technology-enabled tools such as GAS into its audit methodologies. The modern internal audit function should realise that the use and integration of technology-based tools such as GAS in performing data analytics is no longer a "nice-to-have" but that it has now become a "need-to-have". In other words, the implementation of technology-based tools that will reinvent their individual internal audit functions will sooner or later be driven by necessity and not by choice.

Finally, in the words of Geoffrey Moore, *"Without big data analytics, companies are blind and deaf, wandering out onto the web like a deer on a freeway"* (cited in Dykes, 2012). These words hold equally true for internal audit functions, especially as they are looking for the most effective and efficient means of finding their way through the data that dominates organisations' control environments and information technology systems. It is hoped that the internal audit functions of today take action and continuously strive to become leading-edge internal audit functions that optimally utilise technology, and specifically the use of GAS, to their advantage, and so ensure that they always deliver on their mandates with audits of the highest levels of quality.

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ANNEXURE A: DEFINITION OF KEY TERMS

This study involves a number of audit-specific, key terms. The meanings of these key terms, as used in this study, are presented below.

KEY TERM	DEFINITION	SOURCE(S)
Chief Audit Executive (CAE)	The head of the internal audit function who has the responsibility to manage the internal audit function effectively.	IIA (2012a).
Computer Assisted Audit Techniques (CAATs)	Computer-based tools and techniques that permit auditors to increase their personal productivity as well as that of the audit function, by processing large volumes of data at high speed.	Coderre (2009:5); IAASB (2015 ISA 330 par.A16).
Population	All the items in the account or group being audited. Also referred to as *universe* or *field*.	Guy, Carmichael & Whittigton (2002:34); IAASB (2015 ISA 530 par.5(b)).
Statistical sampling	Employs probability-based techniques that enable the internal auditor to draw statistically backed inferences about the entire population under review, and it also allows for the calculation of sampling risk.	Hitzig (2004:31); Maingot & Quon (2009:218); IAASB (2015 ISA 530 par. 5(g)); Stuart, (2012:237).
Non-statistical sampling	Non-statistical sampling is a technique that is based purely on the auditor's professional judgment and does not make use of the laws of probability, and as such, inferences regarding the entire population under review cannot be made.	Maingot & Quon (2009:218); Moeller (2009:202); IAASB (2015 ISA 530 par. 5(g)); Sawyer (2012:126); Stuart (2012:237); IIA (2013, Practice

KEY TERM	DEFINITION	SOURCE(S)
		Advisory 2320-3).
Sufficient evidence	A term that refers to evidence that is factual, adequate, and convincing so that a prudent, informed person would reach the same conclusions as the auditor.	IIA (2012a:14).
Substantive testing (tests of details)	A test of details of account balances (monetary amounts). Substantive tests are sometimes referred to as “test of bona fides” and “year-end tests”.	Guy *et al.* (2002:15); IAASB (2015 ISA 530 par.A7).
Tests of controls	Used to determine the effectiveness of design and operation of controls.	Guy *et al.* (2002:15); IAASB (2015 ISA 530 par.A7).

ANNEXURE B: DATA ANALYTICS MATURITY FRAMEWORK USED IN THIS STUDY

PEOPLE					
0 (NON-EXISTENT)	**1 (AD HOC)**	**2 (DEVELOPING)**	**3 (REPEATABLE)**	**4 (EMBEDDED)**	**5 (MONITORING)**
The internal audit staff have very limited skills and/or do not have any skills in the use of GAS (i.e. the capabilities and skills in the use of GAS are very limited and/or non-existent) = **Q2.1**	The internal audit staff have limited skills in the use of GAS (i.e. they do have an awareness of the commands or functions that GAS may offer but are not proficient to independently apply the basic functions and commands that are built into the GAS, (for example, running the duplicates, statistics, and summarise commands and drawing of random samples) = **Q3.1** Undertaken by	The internal audit staff have basic skills in the use of GAS (i.e. there is a proficiency in the use of GAS to independently apply the basic functions and commands built into the GAS, (for example, running and interpreting the results of the duplicates, sampling and summarise commands) but do not have the ability to write scripts? = **Q3.2** A specialist is often assigned the role of data analyst to oversee the development of analytic projects and procedures = **Q3.5.1** depending on the	The internal audit staff have advanced skills in the use of GAS (i.e. they are experienced and can apply all the basic functions and commands built into the GAS and also have the ability to write scripts for the automated performance of tests for internal auditing purposes) = **Q3.3** The internal audit function has a "data analytics team" that exhibits advanced skills in the use of GAS (i.e. they are experienced and can apply all the basic commands and functions built into the GAS and also have the ability to write scripts for the automated performance of tests for	The internal audit function has employed specialists (i.e. individual/s with specialist skills such as Data Specialists who have a detailed understanding of IT infrastructure, data sources and how to access the data and/or ERP systems specialists with expert knowledge of ERP systems for example SAP or Oracle etc., to support and enable the internal audit function to conduct data analytics with the use of GAS = **Q3.5.1** The use of GAS to perform data	The internal audit function has employed specialists (i.e. individual/s with specialist skills such as Data Specialists who have a detailed understanding of IT infrastructure, data sources and how to access the data and/or ERP systems specialists with expert knowledge of ERP systems for example SAP or Oracle etc., to support and enable the internal audit function to conduct data analytics with the use of GAS = **Q3.5.1** Higher levels of remuneration and/or

0 (NON-EXISTENT)	1 (AD HOC)	2 (DEVELOPING)	3 (REPEATABLE)	4 (EMBEDDED)	5 (MONITORING)
	auditors who have received introductory training = **Q3.1** There is usually little involvement from management to encourage the use of GAS = **Q3.6.3** Often an individual auditor with technical interests selects the analytic software, which is then used by that individual or only a limited number of specialists within the broader audit team = **Q3.5.1** depending on the number of specialists **Q6.1** and **Q6.1.1** depending on the answer provided	number of specialists Starting to become aware of the possibilities. Generalised software tools employed with known limitations = **Q3.2** **Q6.1** and **Q6.1.1** depending on the answer provided	the rest of the internal audit function = **Q3.4** There is buy-in and support from audit management to use GAS as part of the internal audit methodology = **Q3.6.3** **Q6.1** and **Q6.1.1** depending on the answer provided	analytics forms part of the internal audit staff's Key Performance Areas (KPA's) = **Q3.6.1** **Q6.1** and **Q6.1.1** depending on the answer provided	reward is linked to staff with specialized data analytical skillsets in the use of GAS, for example, the successful completion of the ACL Certified Data Analyst (ACDA) or Certified IDEA Data Analyst (CIDA) certifications in an effort to attract and retain these skills within your internal audit function = **Q3.6.2** **Q6.1** and **Q6.1.1** depending on the answer provided

PROCESS					
0 (NON-EXISTENT)	**1 (AD HOC)**	**2 (DEVELOPING)**	**3 (REPEATABLE)**	**4 (EMBEDDED)**	**5 (MONITORING)**
The processes in place that support and enable the use of GAS are very limited and/or non-existent = **Q2.1**	The use of data analytics is typically ad hoc and is used for high-level audits or for high-level risk assessments for audit determination (i.e. only high used on high-level and not integrated in every internal audit engagement) = **Q4.2** and **Q4.8.1** - **Q4.8.9** depending on frequency + **Q4.9** + **Q4.7.1** + **Q4.7.2** depending on frequency The use of GAS is an informal arrangement, it is up to the individual internal auditor to decide to make use of GAS as he/she	Commencement of the use of descriptive analytics (i.e. report back on past occurrences - "what happened") - The results of the data analysis are used to report on the frequency of risks or frequency of events that have occurred (new) = **Q4.8.10** depending on frequency + **Q4.8.1** - **Q4.8.9** depending on frequency Commencement of the use of diagnostic analytics (root cause identification) in nature (i.e. "why it happened") - The results of the data analysis are used to conduct a root cause analysis to establish "why" a certain control was	Repeatable use of descriptive analytics (i.e. report back on past occurrences - "what happened") - The results of the data analysis are used to report on the frequency of risks or frequency of events that have occurred (new) = **Q4.8.10** depending on frequency + **Q4.8.1** - **Q4.8.9** depending on frequency Repeatable use of diagnostic analytics (root cause identification) in nature (i.e. "why it happened") - The results of the data analysis are used to conduct a root cause analysis to establish "why" a certain control was not working effectively (new) = **Q4.8.11** depending on frequency	Commencement of predictive analytics - The results of the data analysis are used to identify trends and future risks events. The results of widespread testing can be accumulated and reported to show trends of risk areas and changing risks where, for example, a pattern of an increasing number of a certain type of exceptions becomes obvious (new) = **Q4.8.12** depending on frequency Continuous auditing throughout internal audit function = **Q4.5** + **Q4.8.9** + depending on frequency	Predictive analytics are integrated in the data analysis process - The results of the data analysis are used to identify trends and future risks events. The results of widespread testing can be accumulated and reported to show trends of risk areas and changing risks where, for example, a pattern of an increasing number of a certain type of exceptions becomes Obvious (new) = **Q4.8.12** depending on frequency Alignment and cross-leverageable platform across lines of defence = **Q4.6** Risk coverage, profiles, and other

0 (NON-EXISTENT)	1 (AD HOC)	2 (DEVELOPING)	3 (REPEATABLE)	4 (EMBEDDED)	5 (MONITORING)
	deems fit = **Q4.1** **Q6.1** and **6.1.1** depending on the answer provided	not working effectively (new) = **Q4.8.11** depending on frequency Consideration is given to how analytics can best be applied on every new audit = **Q4.9** Data analytics are narrowly focused on an area or issue and can include a deep dive (i.e. detailed interrogation of the data or related issue) = **Q4.9** + **Q4.8.1** - **Q4.8.9** depending on frequency **Q6.1** and **Q6.1.1** depending on the answer provided	Activities begin to become repeatable = **Q4.8.1** - **Q4.8.9** depending on frequency + **Q4.9** The internal audit function has formalised and implemented procedures, standards, documentation and offers training that provide guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement = **Q4.1** Previously developed data analytics scripts (i.e. custom-built scripts) that have been through a quality assurance review are defined and are readily available for use by the respective internal auditor/s = **Q4.3**	Schedule tests to run regularly against appropriate period data = **Q4.5** + **Q4.8.9** & depending on frequency Custom-built automated scripting and testing is in place and is running according to a predefined schedule = **Q4.5** Comprehensive suits of tests have been developed, tested and are available in a central, controlled environment for use by the internal audit staff = **Q4.4** Significant or all data audited = **Q4.8.7** depending on frequency	constraints captured and used to optimize scheduling = **Q4.6** There are real-time data monitoring with system workflow processes in place by which the control owners in the respective business units in the bank is notified of exceptions and responds to them = **Q4.6** Continuous monitoring throughout business function = **Q4.6** Real-time reporting accessed through self-service business intelligence = **Q4.6** The use of GAS is standard practice throughout the internal audit

0 (NON-EXISTENT)	1 (AD HOC)	2 (DEVELOPING)	3 (REPEATABLE)	4 (EMBEDDED)	5 (MONITORING)
			Repeatable and sustainable, continuous risk assessment process for dynamic audit planning purposes and moving toward CA enablement = **Q4.7.1** + **Q4.7.2** + **Q4.7.3** depending on frequency + **Q4.8.9** depending on frequency + **Q4.9** Full population testing = **Q4.8.7** depending on frequency **Q6.1** and **Q6.1.1** depending on the answer provided	Root-cause understanding of exceptions = **Q4.8.11** depending on frequency Optimised in a repeatable and sustainable process maturing to a CA/CM process = **Q4.7.1** + **Q4.7.2** + **Q4.7.3** depending on frequency + **Q4.8.9** depending on frequency + **Q4.6** + **Q4.9** **Q6.1** and **Q6.1.1** depending on the answer provided	function and is integrated in all audit programs for tests of controls purposes. The audit department relies heavily on data analysis technology during all stages of the audit plan. Many audit processes are automated to ensure the quality and consistency of results. Data analysis technology is acknowledged as an essential component in enabling the audit function to complete their audit plans = **Q4.2** **Q6.1** and **Q6.1.1** depending on the answer provided

TECHNOLOGY					
0 (NON-EXISTENT)	**1 (AD HOC)**	**2 (DEVELOPING)**	**3 (REPEATABLE)**	**4 (EMBEDDED)**	**5 (MONITORING)**
The technology platform in the use of GAS are very limited and/or non-existent = **Q2.1**	Heavy reliance on IT to obtain data (i.e. it is difficult for the internal audit function to obtain access to the organizational data without the support from IT) = **Q5.1** Data analytics are performed with the use of Microsoft Excel rather than with commercial GAS packages such as for example ACL and IDEA = **Q5.6** **Q6.1** and **Q6.1.1** depending on the answer provided	Established data access protocol with IT (i.e. the organizational data is easily accessible from IT) = **Q5.2** Specific audit tools are being used: <u>Example:</u> Start using the basic built-in functions of GAS packages (e.g. ACL or IDEA) <u>without</u> customisation and scripting = **Q2.2** + **Q3.2** Use of Data visualization tools (limited basis) = **Q5.9.1** depending on frequency **Q6.1** and **Q6.1.1** depending on the answer provided	Data sources are readily available = **Q5.2** Specific audit tools are being used: <u>Example:</u> All the basic built-in functions in GAS (e.g. ACL or IDEA) is used together with scripting and developing of customised tests for auditing and data analytics purposes = **Q2.2 + Q3.3** The internal audit function has a well-structured and centrally-managed server environment to store and maintain large data sets and content of the audit analytics processes (e.g. tests, results, audit procedure documentation and related materials) = **Q5.3**	Data access for analysis and tests is secure but easily accessible by stakeholders = **Q5.3 + Q5.4** The internal audit function has access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes = **Q5.4** Data visualisation tools integrated for data input, analytics, and reporting = **Q5.9.1** depending on frequency **Q6.1** and **Q6.1.1** depending on the answer provided	The internal audit function has an automated data extraction, transfer and load capability = **Q5.5** Advanced analytics that were developed by the data analysis specialist/s with expert knowledge of ERP systems are in place and are available for use within the internal audit function = **Q5.8** **Q6.1** and **Q6.1.1** depending on the answer provided

0 (NON-EXISTENT)	1 (AD HOC)	2 (DEVELOPING)	3 (REPEATABLE)	4 (EMBEDDED)	5 (MONITORING)
			Complex processing of large data volumes is typically performed on high-powered servers = **Q5.7** Data access on demand = **Q5.2** Data visualization tools used for reporting (regular basis) = **Q5.9.1** depending on frequency **Q6.1** and **Q6.1.1** depending on the answer provided		

ANNEXURE C: QUESTIONNAIRE USED IN THIS STUDY

A maturity level assessment of the use of Generalised Audit Software (GAS) by internal audit functions in the South African banking industry.

Dear Dear<Title> <Surname>,

I refer to our recent e-mail exchange and wish to thank you for your willingness to participate in this academic research study. As I mentioned in that e-mail correspondence, I am conducting a maturity level assessment of the use of GAS by internal audit functions in the South African banking industry.

For the purpose of this questionnaire, Generalised Audit Software (GAS) is defined as follows:

Generalised Audit Software (GAS) is a data extraction and data analysis software package (e.g., Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA)) designed to read, process and write data with the help of functions performing specific audit routines. It is a tool for implementing Computer Assisted Auditing Techniques (CAATs). Functions of GAS include importing computerised data which is then subjected to various statistical and analytical functions: the data can be browsed, sorted, summarized, stratified, analysed and sampled, and calculations, conversions and other operations may then be performed on it.

In addition, with reference to the purpose of this questionnaire and to the definition of GAS provided above, software packages such as *Microsoft Excel (or similar)* *is not classified as GAS*, although they can be used to perform basic data analytical functions for internal auditing purposes.

The questionnaire should take **less than** **30 minutes** to complete.

My research (including this questionnaire) is one of the requirements of a PhD degree in internal audit. My study leaders are Professor D.P. van der Nest, a senior staff member of the Tshwane University of Technology in the Department of Auditing, and Professor D.S. Lubbe, a senior staff member in the School of Accountancy at the University of the Free State. A letter from my study leaders confirming my participation in this study programme forms part of this communication.

The questions which follow solicit your opinions and estimates of the degree to which Generalised Audit Software (GAS) is employed by your internal audit function, in your capacity as Head of Internal Audit. Where an **estimate** is requested, kindly base your response on your **recollection** of the characteristics of the use of GAS by you or your department in the **past 12 months**. The questionnaire is based on your impressions and recollections; therefore, it is **not** necessary to find specific and accurate data from your records in order to respond.

For the purpose of this questionnaire, "tests of controls" refers to testing the adequacy and effectiveness of internal controls.

We would greatly appreciate it if you would answer **all** questions as unanswered questions will have a negative impact on the subsequent analysis of the questionnaire data.

Your response to this questionnaire will be treated in complete confidence, which means that neither your bank's name, nor your own name nor any other identifying data, will be connected to any specific answers provided. The results of the analysis of the questionnaire responses will only be presented in a summarised format.

The completed questionnaire can be returned via any of the following options:

Option 1: The questionnaire can be completed electronically (by selecting the "check boxes") and e-mailed back to me at: smidtla@tut.ac.za; or

Option 2: The questionnaire can be printed and completed manually. The questionnaire can then be scanned and e-mailed back to me at smidtla@tut.ac.za; or

Option 3: The questionnaire can be printed and completed manually. The questionnaire can then be posted via registered post to the following postal address: PO Box 3363, Montanapark, Pretoria, 0159.

I would appreciate it if you could return the completed questionnaire to me by 5 August 2016.

I may also request a brief telephonic interview with you should it be necessary to clarify any of your responses, once I have received the completed questionnaire.

Once my research has been finalised I will provide you with a summary of the results. These should prove useful to you in that they will enable you to benchmark your department's responses against those of the other nine locally controlled banks.

Thank you in advance for your time in completing this questionnaire.

Louis Smidt (M.Com, CIA, CRMA)
Lecturer: Department of Auditing
Tshwane University of Technology
Mobile: 072 130 3030

Section 1: Personal information of respondent.

Q1.1 My professional credentials include (**select all that apply**):

- ☐ Certified Fraud Examiner (CFE)
- ☐ Chartered Accountant CA (SA)
- ☐ Certified Internal Auditor (CIA)
- ☐ Certified Information Systems Auditor (CISA)
- ☐ Other **

** If you selected "Other" please provide details:

____

____

____

____

Q1.2 How many full time internal auditors are employed in your internal audit function?

☐

Q1.3 Please indicate how many years' experience **you** have in internal auditing.

☐

Q1.4 Please indicate how many years' experience **you** have with the use of Generalised Audit Software (GAS) for internal auditing purposes.

☐

Q1.5 I consider myself to be (**select only one**):

- ☐ IT Auditor
- ☐ Internal Auditor
- ☐ Financial Auditor
- ☐ Other **

** If you selected "Other" please provide details:

Q1.6 My current position is best described as (**select only one**):

- ☐ Head of Internal Audit
- ☐ Other **

** If you selected "Other" please provide details:

Section 2: The use of GAS for tests of controls.

Q2.1 Does your internal audit department currently use GAS (for example, ACL or IDEA) for data analytics purposes in obtaining audit evidence for conducting tests of controls? *Please take note of the definition of GAS provided on page 1 when answering this question* (**Select only one**):

☐ Yes

☐ No

If you responded "Yes", please complete the rest of the questionnaire (questions 2.2 – 6.2).

If you responded "No", please briefly explain what other techniques or technology/ tools are used in your department in order to collect audit evidence for tests of controls purposes. In addition, indicate what the reasons are for not currently using GAS as part of your internal audit methodology.

____
____
____

Q2.2 If your internal audit function makes use of GAS, which of the following products do you use? (**Select all that apply**):

☐ ACL

☐ Caseware IDEA

☐ Active Data

☐ Active Audit

☐ Top CAATs

☐ Other **

** If you selected "Other" please provide details:

____
____
____
____

Q2.3 Provide an estimate of the percentage of internal audit engagements (as per your annual audit plan) that are performed with the use of GAS. (**Select only one**):

☐ 81-100%

☐ 61-80%

☐ 41-60%

☐ 21-40%

☐ Less than or equal to 20%

Section 3: The ability of internal audit team members to embrace data analytics.

Q3 For **each** of the questions below, select the response that **best** describes your internal audit function's **capabilities** in the use of GAS. Please base your response on your best estimation of the total internal audit staff compliment that conforms to the respective statements across **all** the statements below.

No.	Question/Statement	Less than or equal to 20%	21-40%	41-60%	61-80%	81-100%
3.1	What percentage of **internal audit staff** have **limited** skills in the use of GAS (i.e., they do have an awareness of the commands or functions that GAS may offer but are not proficient enough to independently apply the basic functions and commands that are built into the GAS (for example: not able to run the duplicates, statistics, and summarise commands, or to draw random samples)?	☐	☐	☐	☐	☐
3.2	What percentage of your **internal audit staff** have **basic** skills in the use of GAS (i.e., their proficiency in the use of GAS is sufficient to enable them to independently apply the basic functions and commands built into the GAS (for example: they can run and interpret the results of the duplicates, sampling and summarise commands) but **do not** have the ability to write scripts?	☐	☐	☐	☐	☐

No.	Question/Statement	Less than or equal to 20%	21-40%	41-60%	61-80%	81-100%
3.3	What percentage of the **internal audit staff** exhibits **advanced** skills in the use of GAS (i.e., they are experienced and can apply all the basic functions and commands built into the GAS **and** also have the ability to write scripts for the automated performance of tests for internal auditing purposes)?	☐	☐	☐	☐	☐

Q3.4 Does your internal audit function also have a "data analytics team" that exhibits **advanced** skills in the use of GAS (i.e., they are experienced and can apply all the basic functions and commands built into the GAS **and** also have the ability to write scripts for the automated performance of tests for the rest of the internal audit function)? (**Select only one**):

☐ Yes

☐ No

Q3.4.1 If you responded "Yes", please indicate how many staff members form part of the "data analytics team."

☐

Q3.5 Within your internal audit function, do you also have individuals with specialist skills such as **Data Specialists** (who have a sufficiently detailed understanding of IT infrastructure and data sources to be able to access the data), and/or **ERP systems specialists** (who have expert knowledge of ERP systems such as SAP or Oracle) to support and enable the internal audit function to conduct data analytics with the use of GAS? (**Select only one**):

☐ Yes

☐ No

Q3.5.1 If you responded “Yes”, please indicate how many such specialists there are in total in your internal audit function.

☐

Q3.6 For **each** of the statements below, select the response that **best** describes your internal audit function’s use of GAS.

Q3.6.1 The use of GAS is one of your internal audit staff’s Key Performance Areas (KPA’s). (**Select only one**):

☐ Yes

☐ No

Q3.6.2 Higher levels of remuneration and/or reward is linked to internal audit staff with specialized data analytical skillsets in the use of GAS (for example, the successful completion of the ACL Certified Data Analyst (ACDA) or Certified IDEA Data Analyst (CIDA) certifications), in an effort to attract and retain these skills within your internal audit function. (**Select only one**):

☐ Yes

☐ No

Q3.6.3 There is buy-in and support from audit management for the use of GAS as part of the internal audit methodology. (**Select only one**):

☐ Yes

☐ No

Section 4: Processes in place that support and enable the use of GAS

Q4 For **each** of the statements below, select the response that **best** describes your internal audit function's **processes** for the use of GAS.

Q4.1 Please select **one** of the following statements that **best** describes your internal audit function's use of GAS. (**Select only one**):

☐ The use of GAS is an informal arrangement: it is up to the individual internal auditor to decide whether or not to make use of GAS as he/she deems fit.

☐ The internal audit function has formalised and implemented procedures, standards, and documentation, and offers training that provide guidance to the internal audit staff on how GAS and data analytics should be applied on an internal audit engagement.

Q4.2 The use of GAS is standard practice throughout your internal audit function (i.e., it is integrated in all audit programs) for tests of controls purposes. (**Select only one**):

☐ Yes

☐ No

Q4.3 Previously developed data analytics scripts (i.e., custom-built scripts) that have been through a quality assurance review are defined and are readily available for use by the respective internal auditors. (**Select only one**):

☐ Yes

☐ No

Q4.4 Comprehensive suites of tests have been developed and tested, and are available in a central, controlled environment for use by the internal audit staff. (**Select only one**):

☐ Yes

☐ No

Q4.5 Custom-built automated scripting and testing is in place and is running according to a predefined schedule (i.e., continuous auditing). (**Select only one**):

☐ Yes

☐ No

Q4.6 There are real-time data monitoring with system workflow processes in place through which the control owners in the respective business units in the bank are notified of exceptions, and are able to respond to them (i.e., continuous monitoring). (**Select only one**):

☐ Yes

☐ No

Q4.7 Please indicate the **frequency** of the use of GAS in **each** of the following systematic phases of the internal audit approach:

No.	Question/Statement	Never	Rarely	Sometimes	Often	Always
4.7.1	To conduct risk-based annual audit planning (i.e., to identify areas in the bank, based on the risk associated with such areas, that warrant emphasis for inclusion as an engagement on the annual audit coverage plan).	☐	☐	☐	☐	☐
4.7.2	For engagement planning purposes (i.e., identification of high risk areas or anomalies that warrant further emphasis for inclusion in the engagement scope).	☐	☐	☐	☐	☐
4.7.3	Audit specific data stored in GAS (i.e., logs) that are used to support and inform monitoring and follow-up on previously reported audit findings.	☐	☐	☐	☐	☐

No.	Question/Statement	Never	Rarely	Sometimes	Often	Always
4.7.4	Other **	☐	☐	☐	☐	☐

** If you selected "Other" please provide details:

____
____
____
____

Q4.8 Please indicate **how often** your internal audit function makes use of GAS during separate internal audit engagements for **each** of the <u>purposes</u> listed below:

No.	Question/Statement	Never	Rarely	Sometimes	Often	Always
4.8.1	To obtain audit evidence about control effectiveness.	☐	☐	☐	☐	☐
4.8.2	To identify transactions with specific characteristics or control criteria for tests of controls purposes.	☐	☐	☐	☐	☐
4.8.3	To identify account balances over a certain amount.	☐	☐	☐	☐	☐
4.8.4	For risk identification purposes.	☐	☐	☐	☐	☐
4.8.5	To evaluate fraud risks.	☐	☐	☐	☐	☐
4.8.6	For selecting random samples for tests of controls purposes from key electronic files.	☐	☐	☐	☐	☐
4.8.7	For conducting full population analysis.	☐	☐	☐	☐	☐

No.	Question/Statement	Never	Rarely	Sometimes	Often	Always
4.8.8	To re-perform procedures (e.g., aging of account receivables).	☐	☐	☐	☐	☐
4.8.9	For the generation of exception reports through continuous auditing.	☐	☐	☐	☐	☐
4.8.10	The results of the data analysis are used to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events.	☐	☐	☐	☐	☐
4.8.11	The results of the data analysis are used to conduct a root cause analysis to establish "why" a certain control was not working effectively.	☐	☐	☐	☐	☐
4.8.12	The results of the data analysis are used to identify trends and to predict future risk events.	☐	☐	☐	☐	☐
4.8.13	Other **	☐	☐	☐	☐	☐

** If you selected "Other" please provide details:

____

____

____

____

Q4.9 Do you believe GAS can be utilized more frequently than it is at present, within your internal audit function? (**Select only one**):

☐ Yes

☐ No

Q4.9.1 Please explain your answer briefly:

____

____

____

____

Section 5: The technology platform that enables the performance of data analytics

Q5 For **each** of the statements below, select the response that **best** describes the **technology** aspect of your internal audit function with regard to the use of GAS.

Q5.1 It is difficult for the internal audit function to obtain access to the organizational data without support from IT. (**Select only one**)

☐ Yes

☐ No

Q5.2 The internal audit function has an established data access protocol with the IT department that enables it to obtain data for audit and analytical purposes (i.e., the organizational data is easily accessible through the IT department). (**Select only one**):

☐ Yes

☐ No

Q5.3 The internal audit function has a well-structured and centrally-managed server environment which stores and maintains large data sets and the contents of the audit analytics processes (e.g., tests, results, audit procedure documentation and related materials). (**Select only one**):

☐ Yes

☐ No

Q5.4 The internal audit function has access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes. (**Select only one**):

☐ Yes

☐ No

Q5.5 The internal audit function has an automated data extraction, transfer and load capability. (**Select only one**):

☐ Yes

☐ No

Q5.6 Data analytics are performed with the use of **Microsoft Excel** (or similar) rather than with commercial GAS packages such as ACL and IDEA. *Please take note of the definition of GAS provided on page 1 when answering this question.* (**Select only one**):

☐ Yes

☐ No

Q5.7 Complex processing of large data volumes is performed on high-powered servers. (**Select only one**):

☐ Yes

☐ No

Q5.8 Advanced analytics that have been developed by the data analysis specialists with expert knowledge of ERP systems (e.g., SAP or Oracle) are in place and are available for use within the internal audit function. (**Select only one**):

☐ Yes

☐ No

Q5.9 Please indicate how **frequently** your internal audit function makes use of **data visualization tools** for reporting purposes (i.e., to present complex data in an understandable format through visual depictions such as statistical graphics, plots, information graphics, tables, and charts):

No.	Question/Statement	Never	Rarely	Sometimes	Often	Always
5.9.1	The internal audit function makes use of data visualization tools for reporting purposes.	☐	☐	☐	☐	☐

Section 6: Additional information regarding the use of GAS by your internal audit function.

Q6.1 How satisfied are you with the current degree to which GAS has been implemented by your internal audit function? (**Select only one**):

☐ Very satisfied: no improvement required.

☐ Reasonably satisfied: however, some improvement may be required.

☐ Neither satisfied or dissatisfied: functional but not yet optimal.

☐ Dissatisfied: requires improvement.

☐ Significantly dissatisfied: requires major improvement.

Q6.1.1 Please explain your answer briefly:

____
____
____
____

Q6.2 Please feel free to provide any <u>additional information</u> that you feel may add value to this study, and more specifically with regard to the application of GAS by internal auditors in the South African banking industry.

____
____
____

PLEASE ENSURE THAT <u>ALL</u> QUESTIONS HAVE BEEN COMPLETED AND ALSO ENSURE THAT AN <u>EXPLANATION</u> HAS BEEN PROVIDED WHERE REQUESTED

Thank you for your cooperation. Please remember to return the completed questionnaire by **5 August 2016** using one of the options indicated on page 2.

ANNEXURE D: OPENING E-MAIL SENT TO RESPONDENTS

Dear <Title> <Surname>,

I would firstly like to thank you once again for your kindness in participating in my Masters research study that was conducted in 2013. That research study investigated the use of sampling techniques by internal audit functions in the South African banking industry. Your generous participation enabled me to successfully complete my Masters degree in 2014. I am now in the process of completing my PhD degree in Internal Audit, which requires additional empirical research.

Your participation in my study would be greatly appreciated as it would ensure that my research is based on well-considered input from senior executives in the internal audit environment, thus ensuring that meaningful conclusions are reached.

My research dissertation is entitled *"A maturity level assessment of the use of generalised audit software (GAS) by internal audit functions in the South African banking industry."*

I have attached a letter from my study leaders, Professors Lubbe and van der Nest, confirming my registration for my PhD, and the registration of the research topic.

It would also be greatly appreciated if you could let me know if you will be able to participate in my study by responding to this e-mail, if possible by the **1st of July 2016**.

In order to speed up possible follow-up communications, should you agree to participate, I would appreciate it if you could also provide me with a direct contact phone or mobile number, either for yourself or your personal assistant.

Should you indicate your willingness to participate, I will e-mail you the research questionnaire by 29 July 2016. The questionnaire should take approximately 30 minutes to complete, and I would like to have all completed questionnaires returned to me by 12 August 2016.

My mobile number is 072 130 3030, should you have any questions at this stage.

Thank you in advance for your participation.

Louis Smidt (M.Com (Auditing), CIA, CRMA)
Department of Auditing
Office: +27 12 382 0717
E-mail: smidtla@tut.ac.za

ANNEXURE E: COVER LETTER PROVIDED BY STUDY LEADERS

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA
UFS·UV
ECONOMIC AND MANAGEMENT SCIENCES
EKONOMIESE EN BESTUURSWETENSKAPPE

27 June 2016

Dear<Title> <Surname>,

Request for participation in an academic research project forming part of the PhD (Auditing) degree being undertaken by Mr. Louis Smidt

With the now near daily advances in technology, most organisations are impacted by changes in information technology (IT), which are generating an ever-increasing volume of audit evidence, most of which is now almost exclusively available in electronic format. Technology is thus playing an increasingly important role in the manner in which internal audit is practiced today. As a result, it is now almost impossible to conduct effective audits without the use of technology. In the words of Richard Chambers (current president of the Institute of Internal Auditors (IIA) International), *"We are going from a period of 'Big Data' to a period of 'Mega Data', of 'Bigger than Big data'."* According to the IIA's latest edition of its International Standards for the Professional Practice of Internal Auditing (Standard 1220.A2, *Due Professional Care*), internal auditors are now *required* to utilise technology-based tools in the execution of their responsibilities.

As the head of the internal audit function at (name of bank), you will also be aware of the fact that the internal audit function interacts with multiple stakeholders in the conduct of its duties.

These stakeholders often have different expectations from the internal audit function, resulting in additional pressure being put on the internal audit function to provide "meaningful" outputs. In addition, the rising expectations of these stakeholders (such as to be more efficient and to achieve more with less, and to deliver more robust and effective analysis of key matters), have also increased internal audit workloads, which puts the internal audit resources under further pressure. In an effort to respond positively to these escalating pressures, the internal audit functions have to be innovative and increasingly efficient in their use of tools and techniques such as Computer Assisted Audit Techniques (CAATs), in order to collect sufficient, reliable and useful evidence when performing tests of controls.

The most popular and frequently used CAAT is generalised audit software (GAS), such as, amongst others, Audit Command Language (ACL) and Interactive Data Extraction and Analysis (IDEA) software packages. The main purpose of this current study is to conduct a maturity level assessment of the use of GAS by internal audit functions in the South African banking industry.

We humbly request your participation in this research project. Your responses are important as the collected data will be representative of the situation in the financial services, auditing and accounting industries in which you function. Your input and shared insights will therefore be of immense value to these industries, and will be key to the integrity and success of this research project.

The research process will be as follows:

1) A questionnaire will be e-mailed to those agreeing to participate (completion thereof should take approximately 30 minutes); and

2) A brief telephonic interview (if necessary) will be scheduled with you once you have returned the completed questionnaire and it has been analysed.

It would be appreciated if you could indicate whether you are willing to participate in this research project by the **1st of July 2016**. Those who have indicated their willingness to participate will then receive the research questionnaire via e-mail. A two (2) week turnaround time has been allowed for the completion thereof.

All responses and any additional information that respondents provide will be treated in the strictest confidence and in compliance with the university's ethics in research policy. No reference or quotation made in the study will be linked to any specific respondent, nor to any specific bank.

The responses that you provide will be aggregated and processed together with the responses of all other respondents in order to determine trends and perceptions within the industry and to determine the current level of maturity of the use of GAS by internal audit functions in the South African banking industry. We believe that the results of the study could be of great value to members of the auditing profession, to professional auditing bodies like the IIA and ISACA, as well as to the members of the national and international banking sector.

We would like to thank you in advance for considering our request that you participate in this research project. Your participation would greatly assist our PhD candidate, Mr. Louis Smidt, to complete his degree successfully.

We look forward to your positive response, and trust that the information that will come out of this research will also be of use to you.

Yours sincerely

____

Prof. D.P. van der Nest
(Study leader)
Department of Auditing
Tshwane University of Technology

____

Prof D.S Lubbe
(Co-study leader)
Department of Accounting
University of the Free State

ANNEXURE F: FOLLOW-UP E-MAIL SENT TO [SLOW] RESPONDENTS

Dear <Title> <Surname>,

We recently spoke about my PhD degree research project, and you kindly undertook to complete the proposed research questionnaire. I forwarded the questionnaire to you on 12 July.

I have as yet not received your completed questionnaire. I trust that your schedule is very busy, but I will be grateful if you could perhaps spare **<u>30 minutes</u>** of your valuable time in completing this survey.

Your response will enable me to meet the requirements of a PhD degree in internal audit that I am currently busy with.

As the South African domestic banking industry is particularly small (in number of locally owned banks registered with the Reserve Bank) it is extremely important to the integrity of my research data that I obtain input from all ten Heads of Internal Audit representing the locally controlled banking industry.

I have again attached the survey to this email.

Thank you again for your willingness to participate in this research project. I trust you will be able to complete the survey for me and to return it **<u>by Friday 12 August .</u>**

Once my research has been finalised I will provide you with a summary of the results. These should prove useful to you in that they will enable you to benchmark your department's responses against the other nine locally controlled banks.

Kind regards

Louis Smidt (M.Com (Internal Auditing), CIA, CRMA)
Department of Auditing
Office: +27 12 382 0717
E-mail: smidtla@tut.ac.za

ANNEXURE G: DESCRIPTIVE STATISTICS FOR ALL CATEGORICAL VARIABLES

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
Section 1 - Personal information of respondent			
1.1.1 My professional credentials include CFE.	Yes	0	0.0%
	No	9	100.0%
1.1.2 My professional credentials include CA (SA).	Yes	4	44.4%
	No	5	55.6%
1.1.3 My professional credentials include CIA.	Yes	1	11.1%
	No	8	88.9%
1.1.4 My professional credentials include CISA.	Yes	4	44.4%
	No	5	55.6%
1.1.5 My professional credentials include "Other".	Yes	2	22.2%
	No	7	77.8%
1.1.5.1 Details of other:	Internal Audit Techniques and Professional Internal Auditor		
	MSc Financial Engineering		
1.5.1 I consider myself to be: IT Auditor.	Yes	1	11.1%
	No	8	88.9%
1.5.2 I consider myself to be: Internal Auditor.	Yes	5	55.6%
	No	4	44.4%
1.5.3 I consider myself to be:	Yes	1	11.1%

VARIABLES		CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	Financial Auditor.	No	8	88.9%
1.5.4	I consider myself to be: Other.	Yes	3	33.3%
		No	6	66.7%
1.5.4.1	Details of other:	Chief Internal Auditor		
		General Management		
		Head of Internal Audit		
1.6	My current position is best described as:	Head of Internal Audit	7	77.8%
		Other	2	22.2%
1.6.1	Details of other.	Chief Auditor Internal		
		IT Audit Manager		
Section 2 - The use of GAS for tests of controls.				
2.1	Does your internal audit department currently use GAS for data analytics purposes in obtaining audit evidence for conducting tests of controls?	Yes	7	77.8%
		No	2	22.2%
2.1.1	Explain if you answered no.	We are currently working towards using GAS as part of our reviews. Like to implement ACL as their preferred GAS tool		
2.2.1	If your internal audit function makes use of GAS, do you use ACL?	Yes	7	77.8%
		No	2	22.2%
2.2.2	If your internal audit function makes use of GAS, do you use	Yes	0	0.0%
		No	9	100.0%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
Caseware IDEA?			
2.2.3 If your internal audit function makes use of GAS, do you use Active Data?	Yes	0	0.0%
	No	9	100.0%
2.2.4 If your internal audit function makes use of GAS, do you use Active Audit?	Yes	0	0.0%
	No	9	100.0%
2.2.5 If your internal audit function makes use of GAS, do you use Top CAATs?	Yes	0	0.0%
	No	9	100.0%
2.2.6 If your internal audit function makes use of GAS, do you use Other?	Yes	3	33.3%
	No	6	66.7%
2.2.6.1 Details of other:	Microsoft Access		
	SAS, SQL		
	SQL		
2.3 Provide an estimate of the percentage of internal audit engagements that are performed with the use of GAS.	<20%	3	33.3%
	21-40%	3	33.3%
	41-60%	2	22.2%
	61-80%	0	0.0%
	81-100%	1	11.1%
Section 3 - The ability of internal audit team members to embrace data analytics			
3.1 What percentage of internal	<20%	1	11.1%

VARIABLES		CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	audit staff has limited skills in the use of GAS?	21-40%	3	33.3%
		41-60%	3	33.3%
		61-80%	2	22.2%
		81-100%	0	0.0%
3.2	What percentage of internal audit staff has basic skills in the use of GAS?	<20%	3	33.3%
		21-40%	6	66.7%
		41-60%	0	0.0%
		61-80%	0	0.0%
		81-100%	0	0.0%
3.3	What percentage of internal audit staff exhibits advanced skills in the use of GAS?	<20%	6	66.7%
		21-40%	2	22.2%
		41-60%	1	11.1%
		61-80%	0	0.0%
		81-100%	0	0.0%
3.4	Does your internal audit department also have a data analytics team that exhibits advanced skills in the use of GAS?	Yes	5	55.6%
		No	4	44.4%
3.4.1	If yes, indicate how many staff members.	3		
		5		
		6		
		6		

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	20-30		
3.5 Within your internal audit function, do you also have individuals with specialist skills such as Data Specialists, and/or ERP systems specialists to support and enable the internal audit function to conduct data analytics with the use of GAS?	Yes	7	77.8%
	No	2	22.2%
3.5.1 If yes indicate how many specialists.	1		
	2		
	2		
	3		
	5		
	5		
	10-15		
3.6.1 The use of GAS is one of your internal audit staff's Key Performance Areas (KPA's)?	Yes	4	44.4%
	No	5	55.6%
3.6.2 Higher levels of remuneration and/or reward is linked to internal audit staff with specialized data analytical skillsets in the use of GAS, in an effort to attract and retain these skills within your audit function?	Yes	3	33.3%
	No	6	66.7%
3.6.3 There is buy-in and support from	Yes	8	88.9%

VARIABLES		CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	audit management for the use of GAS as part of the internal audit methodology?	No	1	11.1%
Section 4 - Processes in place that support and enable the use of GAS				
4.1	Select one of following statements that best describes your internal audit function's use of GAS.	Informal arrangement	4	44.4%
		Formal arrangement	5	55.6%
4.2	The use of GAS is standard practice throughout your internal audit function for tests or controls purposes.	Yes	3	33.3%
		No	6	66.6%
4.3	Previously developed data analytics scripts that have been through a quality assurance review are defined and are readily available for use by the respective auditors.	Yes	3	33.3%
		No	6	66.6%
4.4	Comprehensive suites of tests have been developed and tested, and are available in a central, controlled environment for use by the internal audit staff.	Yes	1	11.1%
		No	8	88.9%
4.5	Custom-built automated scripting and testing is in place and is running according to a predefined schedule.	Yes	2	22.2%
		No	7	77.8%
4.6	There are real-time data monitoring with system workflow	Yes	2	22.2%
		No	7	77.8%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
processes.			
4.7.1 Frequency of use of GAS to conduct risk-based annual audit planning.	Never	3	33.3%
	Rarely	4	44.4%
	Sometimes	0	0.0%
	Often	1	11.1%
	Always	1	11.1%
4.7.2 Frequency of use of GAS for engagement planning purposes.	Never	0	0.0%
	Rarely	3	33.3%
	Sometimes	4	44.4%
	Often	1	11.1%
	Always	1	11.1%
4.7.3 Frequency of use of GAS to audit specific data stored in GAS	Never	2	22.2%
	Rarely	2	22.2%
	Sometimes	1	11.1%
	Often	3	33.3%
	Always	1	11.1%
4.7.4 Frequency of use of GAS for Other.	Never	0	0.0%
	Rarely	0	0.0%
	Sometimes	0	0.0%
	Often	0	0.0%
	Always	1	11.1%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	The data analytics team maintains the DAC with all key risks, key applications, tests performed, and outcome per audit assignment. This serves as a good base of possible tests across all clusters for either new or repeated audits.		
4.8.1 Frequency internal audit function make use of GAS to obtain audit evidence about control effectiveness.	Never	0	0.0%
	Rarely	1	11.1%
	Sometimes	3	33.3%
	Often	4	44.4%
	Always	1	11.1%
4.8.2 Frequency internal audit function make use of GAS to identify transactions with specific characteristics or control criteria for tests of control purposes.	Never	0	0.0%
	Rarely	1	11.1%
	Sometimes	3	33.3%
	Often	3	33.3%
	Always	2	22.2%
4.8.3 Frequency internal audit function make use of GAS to identify account balances over a certain amount.	Never	0	0.0%
	Rarely	1	11.1%
	Sometimes	4	44.4%
	Often	2	22.2%
	Always	2	22.2%
4.8.4 Frequency internal audit function make use of GAS for risk identification purposes.	Never	0	0.0%
	Rarely	5	55.6%
	Sometimes	2	22.2%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	Often	2	22.2%
	Always	0	0.0%
4.8.5 Frequency internal audit function make use of GAS to evaluate fraud risks.	Never	1	11.1%
	Rarely	4	44.4%
	Sometimes	2	22.2%
	Often	2	22.2%
	Always	0	0.0%
4.8.6 Frequency internal audit function make use of GAS for selecting random samples for tests of control purposes from key electronic files.	Never	1	11.1%
	Rarely	2	22.2%
	Sometimes	2	22.2%
	Often	3	33.3%
	Always	1	11.1%
4.8.7 Frequency internal audit function make use of GAS for conducting full population analysis	Never	0	0.0%
	Rarely	2	22.2%
	Sometimes	2	22.2%
	Often	3	33.3%
	Always	2	22.2%
4.8.8 Frequency internal audit function make use of GAS to re-perform procedures.	Never	0	0.0%
	Rarely	3	33.3%
	Sometimes	3	33.3%
	Often	2	22.2%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	Always	1	11.1%
4.8.9 Frequency internal audit function makes use of GAS for the generation of exception reports through continuous auditing.	Never	1	11.1%
	Rarely	4	44.4%
	Sometimes	2	22.2%
	Often	1	11.1%
	Always	1	11.1%
4.8.10 Frequency internal audit function make use of GAS to use the results of the data analysis to identify and report on the frequency and occurrence of risks or frequency of occurrence of specific events	Never	0	0.0%
	Rarely	1	11.1%
	Sometimes	3	33.3%
	Often	4	44.4%
	Always	1	11.1%
4.8.11 Frequency internal audit function makes use of GAS to use the results of the data analysis to conduct a root cause analysis to establish why a certain control was not working effectively.	Never	0	0.0%
	Rarely	5	55.6%
	Sometimes	1	11.1%
	Often	2	22.2%
	Always	1	11.1%
4.8.12 Frequency internal audit function make use of GAS to use the results of the data analysis to identify trends and to predict future risk events.	Never	2	22.2%
	Rarely	2	22.2%
	Sometimes	3	33.3%
	Often	2	22.2%
	Always	0	0.0%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
4.8.13 Frequency internal audit function makes use of GAS for "Other" purposes.	Sometimes	1	11.1%
4.9 Do you believe GAS can be utilised more frequently than it is at present, within you internal audit function?	Yes	8	88.9%
	No	1	11.1%
4.9.1 Please explain your answer briefly.	Already integral part of audit processes.		
	Currently, GAS is largely used by our "Data Analytics" team (for some years). In the last 6 months, we have commenced with implementing GAS across the team.		
	From 1 April 2016 we have approval for an additional headcount, a data analyst, to join the team and drive our analytics strategy. At present, analytics is decentralised within our team.		
	Should be part of as many audits as possible towards enhancing effectiveness and efficiency of our audit reviews.		
	The use of GAS is dependent on the ability to timeously obtain data in the required format. GAS has been implemented in areas where the data is easily obtainable however there is other areas for which there are hurdles in obtaining data timeously due to the safeguards in place to maintain the security of data.		
	We are currently using it on a limited basis. The audit environment could definitely benefit from more extensive use of the tools.		
Section 5 - The technology platform that enables the performance of data analytics			
5.1 It is difficult for the internal audit	Yes	7	77.8%

VARIABLES		CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	function to obtain access to the organisation data without support from IT?	No	2	22.2%
5.2	The internal audit function has an established data access protocol with the IT department that enables it to obtain data for audit and analytical purposes?	Yes	4	44.4%
		No	5	55.6%
5.3	The internal audit function has a well-structured and centrally-managed server environment which stores and maintains large data sets and the contents of the audit analytics processes?	Yes	2	22.2%
		No	7	77.8%
5.4	The internal audit function has access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes	Yes	4	44.4%
		No	5	55.6%
5.5	The internal audit function has an automated data extraction, transfer and load capability?	Yes	2	22.2%
		No	7	77.8%
5.6	Data analysis are performed with the use of Microsoft Excel rather than with commercial GAS packages such as ACL and IDEA?	Yes	4	44.4%
		No	5	55.6%
5.7	Complex processing of large data volumes is performed on high powered servers?	Yes	4	44.4%
		No	5	55.6%
5.8	Advanced analytics that have	Yes	3	33.3%

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
been developed by the data analysis specialists with export knowledge of ERP systems are in place and are available for use within the internal audit function?	No	6	66.7%
5.9.1 The internal audit function makes use of data visualization tools for reporting purposes?	Never	2	22.2%
	Rarely	3	33.3%
	Sometimes	3	33.3%
	Often	1	11.1%
	Always	0	0.0%
Section 6			
6.1 How satisfied are you with the current degree to which GAS has been implemented by your internal audit function?	Significant dissatisfied	0	0.0%
	Dissatisfied	6	66.7%
	Neutral	2	22.2%
	Reasonable satisfied	1	11.1%
	Very satisfied	0	0.0%
6.1.1 Explain your answer briefly.	Currently do not use GAS enough. Could benefit therefrom to increase efficiency in audit approach.		
	Currently, GAS is largely used by our "Data Analytics" team (for same years). In the last 6 months, we have commenced with implementing GAS across the team.		
	GAS is currently being utilised wherever possible however there are certain areas where the use of GAS can be		

VARIABLES	CATEGORIES	FREQUENCY	PERCENTAGE OUT OF TOTAL
	enhanced and there are other areas where it is still to be implemented.		
	Our department is in the process of enhancing our data analytics capabilities. An internal audit strategy has been recently drafted and one of its key deliverables is the implementation of continuous audit.		
	Should be part of as many audits as possible towards enhancing effectiveness and efficiency of our audit reviews.		
	We are at the very beginning of a long journey. Our GAS environment is not mature at this stage.		
	We need to speed up the pace of implementing continuous control monitoring, as well as broad adoption of analytics in all audits.		
6.2 Provide additional information.	Advanced Microsoft Excel is extensively used, with a strategic move towards GAS currently in progress.		
	The implementation of GAS should be an integral part of the internal audit function and as a bank we believe that it would be to the detriment of the internal function if such a critical function is not leveraged from an audit processing point of view and a data analytics perspective.		

ANNEXURE H: DESCRIPTIVE STATISTICS OF SURVEY (NUMBER OF RESPONSES, MEAN, STANDARD DEVIATION, MINIMUM, MAXIMUM, MEDIAN AND RANGE)

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
Q1_2	How many full time internal auditors are employed in your internal audit function?	9	80.89	98.2490	26.0	7.0	240.0	233.0
Q1_3	Please indicate how many years you have in internal auditing?	9	12.11	8.3583	7.0	5.0	26.0	21.0
Q1_4	Please indicate how many years' experience you have in the use of GAS for internal audit purposes.	5	8.90	6.4070	10.0	0.5	18.0	17.5
Q2_1	Does your internal audit department currently use GAS for data analytics purposes in obtaining audit evidence for conducting tests of controls?	9	1.11	0.3333	1.0	1.0	2.0	1.0
Q2_3	Provide an estimate of the percentage of internal audit engagements that are performed with the use of GAS	9	2.22	1.3017	2.0	1.0	5.0	4.0
Q3_1	What percentage of internal audit staff has limited skills in the use of GAS?	9	2.67	1.0000	3.0	1.0	4.0	3.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
Q3_2	What percentage of internal audit staff has basic skills in the use of GAS?	9	1.67	0.5000	2.0	1.0	2.0	1.0
Q3_3	What percentage of internal audit staff exhibits advanced skills in the use of GAS?	9	1.44	0.7265	1.0	1.0	3.0	2.0
Q3_4	Does your internal audit department also have a data analytics team that exhibits advanced skills in the use of GAS?	9	1.44	0.5270	1.0	1.0	2.0	1.0
Q3_5	Within your internal audit function, do you also have individuals with specialist skills such as Data Specialists, and/or ERP systems specialists to support and enable the internal audit function to conduct data analytics with the use of GAS	9	1.22	0.4410	1.0	1.0	2.0	1.0
Q3_5_1	How many such specialists are there in total in your internal audit function	6	3.00	1.6733	2.50	1.0	5.0	4.0
Q3_6_1	The use of GAS is one of your internal audit staff's Key Performance Areas (KPA's)	9	1.56	0.5270	2.0	1.0	2.0	1.0
Q3_6_2	Higher levels of	9	1.67	0.5000	2.0	1.0	2.0	1.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
	remuneration and/or reward is linked to internal audit staff with specialized data analytical skillsets in the use of GAS, in an effort to attract and retain these skills within your audit function							
Q3_6_3	There is buy-in and support from audit management for the use of GAS as part of the internal audit methodology	9	1.11	0.3333	1.0	1.0	2.0	1.0
Q4_2	The use of GAS is standard practice throughout your internal audit function for tests or controls purposes	9	1.67	0.5000	2.0	1.0	2.0	1.0
Q4_3	Previously developed data analytics scripts that have been through a quality assurance review are defined and are readily available for use by the respective auditors	9	1.67	0.5000	2.0	1.0	2.0	1.0
Q4_4	Comprehensive suites of tests have been developed and tested, and are available in a central, controlled environment for use by the internal audit	9	1.89	0.3333	2.0	1.0	2.0	1.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
	staff							
Q4_5	Custom-built automated scripting and testing is in place and is running according to a predefined schedule	9	1.78	0.4410	2.0	1.0	2.0	1.0
Q4_6	There are real-time data monitoring with system workflow processes	9	1.78	0.4410	2.0	1.0	2.0	1.0
Q4_7_1	Frequency of use of GAS to conduct risk-based annual audit planning	9	2.22	1.3944	2.0	1.0	5.0	4.0
Q4_7_2	Frequency of use of GAS for engagement planning purposes	9	3.00	1.0000	3.0	2.0	5.0	3.0
Q4_7_3	Frequency of use of GAS to audit specific data stored in GAS	9	2.89	1.4530	3.0	1.0	5.0	4.0
Q4_7_4	Frequency of use of GAS for Other	3	3.33	1.5275	3.0	2.0	5.0	3.0
Q4_8_01	Frequency internal audit function make use of GAS to obtain audit evidence about control effectiveness	9	3.56	0.8819	4.0	2.0	5.0	3.0
Q4_8_02	Frequency internal audit function make use of GAS to identify transactions with specific characteristics or control criteria for tests of control purposes	9	3.67	1.0000	4.0	2.0	5.0	3.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
Q4_8_03	Frequency internal audit function make use of GAS to identify account balances over a certain amount	9	3.56	1.0138	3.0	2.0	5.0	3.0
Q4_8_04	Frequency internal audit function make use of GAS for risk identification purposes	9	2.67	0.8660	2.0	2.0	4.0	2.0
Q4_8_05	Frequency internal audit function make use of GAS to evaluate fraud risks	9	2.56	1.0138	2.0	1.0	4.0	2.0
Q4_8_06	Frequency internal audit function make use of GAS for selecting random samples for tests of control purposes from key electronic files	9	3.11	1.2693	3.0	1.0	5.0	4.0
Q4_8_07	Frequency internal audit function make use of GAS for conducting full population analysis	9	3.56	1.1304	4.0	2.0	5.0	3.0
Q4_8_08	Frequency internal audit function make use of GAS to re-perform procedures	9	3.11	1.0541	3.0	2.0	5.0	3.0
Q4_8_09	Frequency internal audit function make use of GAS for the generation of exception reports through continuous auditing	9	2.67	1.2247	2.0	1.0	5.0	4.0
Q4_8_10	Frequency internal audit function make	9	3.56	0.8819	4.0	2.0	5.0	3.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
	use of GAS to use the results of the data analysis to identify and report on the frequency and occurrence of risks or frequency of occurrence of specific events							
Q4_8_11	Frequency internal audit function make use of GAS to use the results of the data analysis to conduct a root cause analysis to establish why a certain control was not working effectively	9	2.89	1.17	2.0	2.0	5.0	3.0
Q4_8_12	Frequency internal audit function make use of GAS to use the results of the data analysis to identify trends and to predict future risk events	9	2.56	1.1304	3.0	1.0	4.0	3.0
Total for Q4_8	Summative value for the internal audit engagements of all the purposes of the use of GAS.	9	37.44	10.1657	33.0	24.0	53.0	29.0
Q4_9	Do you believe GAS can be utilised more frequently than it is at present, within you internal audit function?	9	1.11	0.3333	1.0	1.0	2.0	1.0
Q5_1	It is difficult for the internal audit function	9	1.22	0.4410	1.0	1.0	2.0	1.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
	to obtain access to the organisation data without support from IT							
Q5_2	The internal audit function has an established data access protocol with the IT department that enables it to obtain data for audit and analytical purposes	9	1.56	0.5270	2.0	1.0	2.0	1.0
Q5_3	The internal audit function has a well-structured and centrally-managed server environment which stores and maintains large data sets and the contents of the audit analytics processes	9	1.78	0.4410	2.0	1.0	2.0	1.0
Q5_4	The internal audit function has access to a central enterprise data store which allows for easy access to data for audit and data analytical purposes	9	1.56	0.520	2.0	1.0	2.0	1.0
Q5_5	The internal audit function has an automated data extraction, transfer and load capability	9	1.78	0.4410	2.0	1.0	2.0	1.0
Q5_6	Data analysis are performed with the	9	1.56	0.5270	2.0	1.0	2.0	1.0

QUESTION	VARIABLE	N	MEAN	STANDARD DEVIATION	MEDIAN	MIN	MAX	RANGE
	use of Microsoft Excel rather than with commercial GAS packages such as ACL and IDEA							
Q5_7	Complex processing of large data volumes is performed on high powered servers	9	1.56	0.5270	2.0	1.0	2.0	1.0
Q5_8	Advanced analytics that have been developed by the data analysis specialists with export knowledge of ERP systems are in place and are available for use within the internal audit function	9	1.67	0.5000	2.0	1.0	2.0	1.0
Q5_9_1	The internal audit function makes use of data visualization tools for reporting purposes	9	2.33	1.0000	2.0	1.0	4.0	3.0
Q6_1	How satisfied are you with the current degree to which GAS has been implemented by your internal audit function?	9	2.44	0.7265	2.0	2.0	4.0	2.0

ANNEXURE I: DESCRIPTIVE STATISTICS FOR ALL THE ORDINAL AND DICHOTOMOUS VARIABLES

VARIABLE	LABEL	N	MEAN	STD DEV	MEDIAN	MINIMUM	MAXIMUM	RANGE
Q2_1	Q2_1	9	1.1111111	0.3333333	1.0000000	1.0000000	2.0000000	1.0000000
Q2_3	Q2_3	9	2.2222222	1.3017083	2.0000000	1.0000000	5.0000000	4.0000000
Q3_1	Q3_1	9	2.6666667	1.0000000	3.0000000	1.0000000	4.0000000	3.0000000
Q3_2	Q3_2	9	1.6666667	0.5000000	2.0000000	1.0000000	2.0000000	1.0000000
Q3_3	Q3_3	9	1.4444444	0.7264832	1.0000000	1.0000000	3.0000000	2.0000000
Q3_4	Q3_4	9	1.4444444	0.5270463	1.0000000	1.0000000	2.0000000	1.0000000
Q3_5	Q3_5	9	1.2222222	0.4409586	1.0000000	1.0000000	2.0000000	1.0000000
Q3_6_1	Q3_6_1	9	1.5555556	0.5270463	2.0000000	1.0000000	2.0000000	1.0000000
Q3_6_2	Q3_6_2	9	1.6666667	0.5000000	2.0000000	1.0000000	2.0000000	1.0000000
Q3_6_3	Q3_6_3	9	1.1111111	0.3333333	1.0000000	1.0000000	2.0000000	1.0000000
Q4_2	Q4_2	9	1.6666667	0.5000000	2.0000000	1.0000000	2.0000000	1.0000000
Q4_3	Q4_3	9	1.6666667	0.5000000	2.0000000	1.0000000	2.0000000	1.0000000
Q4_4	Q4_4	9	1.8888889	0.3333333	2.0000000	1.0000000	2.0000000	1.0000000
Q4_5	Q4_5	9	1.7777778	0.4409586	2.0000000	1.0000000	2.0000000	1.0000000
Q4_6	Q4_6	9	1.7777778	0.4409586	2.0000000	1.0000000	2.0000000	1.0000000
Q4_7_1	Q4_7_1	9	2.2222222	1.3944334	2.0000000	1.0000000	5.0000000	4.0000000
Q4_7_2	Q4_7_2	9	3.0000000	1.0000000	3.0000000	2.0000000	5.0000000	3.0000000
Q4_7_3	Q4_7_3	9	2.8888889	1.4529663	3.0000000	1.0000000	5.0000000	4.0000000
Q4_7_4	Q4_7_4	3	3.3333333	1.5275252	3.0000000	2.0000000	5.0000000	3.0000000
Q4_8_01	Q4_8_01	9	3.5555556	0.8819171	4.0000000	2.0000000	5.0000000	3.0000000
Q4_8_02	Q4_8_02	9	3.6666667	1.0000000	4.0000000	2.0000000	5.0000000	3.0000000
Q4_8_03	Q4_8_03	9	3.5555556	1.0137938	3.0000000	2.0000000	5.0000000	3.0000000
Q4_8_04	Q4_8_04	9	2.6666667	0.8660254	2.0000000	2.0000000	4.0000000	2.0000000
Q4_8_05	Q4_8_05	9	2.5555556	1.0137938	2.0000000	1.0000000	4.0000000	3.0000000
Q4_8_06	Q4_8_06	9	3.1111111	1.2692955	3.0000000	1.0000000	5.0000000	4.0000000
Q4_8_07	Q4_8_07	9	3.5555556	1.1303883	4.0000000	2.0000000	5.0000000	3.0000000
Q4_8_08	Q4_8_08	9	3.1111111	1.0540926	3.0000000	2.0000000	5.0000000	3.0000000
Q4_8_09	Q4_8_09	9	2.6666667	1.2247449	2.0000000	1.0000000	5.0000000	4.0000000
Q4_8_10	Q4_8_10	9	3.5555556	0.8819171	4.0000000	2.0000000	5.0000000	3.0000000
Q4_8_11	Q4_8_11	9	2.8888889	1.1666667	2.0000000	2.0000000	5.0000000	3.0000000
Q4_8_12	Q4_8_12	9	2.5555556	1.1303883	3.0000000	1.0000000	4.0000000	3.0000000
Q4_8_13	Q4_8_13	1	1.0000000	No value	1.0000000	1.0000000	1.0000000	0
Q4_9	Q4_9	9	1.1111111	0.3333333	1.0000000	1.0000000	2.0000000	1.0000000
Q5_1	Q5_1	9	1.2222222	0.4409586	1.0000000	1.0000000	2.0000000	1.0000000

Q5_2	Q5_2	9	1.5555556	0.5270463	2.0000000	1.0000000	2.0000000	1.0000000
Q5_3	Q5_3	9	1.7777778	0.4409586	2.0000000	1.0000000	2.0000000	1.0000000
Q5_4	Q5_4	9	1.5555556	0.5270463	2.0000000	1.0000000	2.0000000	1.0000000
Q5_5	Q5_5	9	1.7777778	0.4409586	2.0000000	1.0000000	2.0000000	1.0000000
Q5_6	Q5_6	9	1.5555556	0.5270463	2.0000000	1.0000000	2.0000000	1.0000000
Q5_7	Q5_7	9	1.5555556	0.5270463	2.0000000	1.0000000	2.0000000	1.0000000
Q5_8	Q5_8	9	1.6666667	0.5000000	2.0000000	1.0000000	2.0000000	1.0000000
Q5_9_1	Q5_9_1	9	2.3333333	1.0000000	2.0000000	1.0000000	4.0000000	3.0000000
Q6_1	Q6_1	9	2.4444444	0.7264832	2.0000000	2.0000000	4.0000000	2.0000000

ANNEXURE J: CODING OF THE DATA

The following coding was applied on the captured data:

Questions 1.1.1-1.1.5, 1.5.1-1.5.4, 2.1, 2.2.1-2.2.6, 3.4, 3.5, 3.6.1-3.6.3, 4.2-4.6, 4.9, 5.1-Q5.8

- "Yes" is coded as 1
- "No" is coded as 2
- "Nothing" is coded as 0

Question 1.6

- "Head of internal Audit" is coded as 1
- "Other **" is coded as 2

Questions 2.3, 3.1-3.3

- "Less than or equal to 20%" is coded as 1
- "21-40%" is coded as 2
- "41-60%" is coded as 3
- "61-80%" is coded as 4
- "81-100%" is coded as 5

Question 4.1

- "The use of GAS is an informal arrangement: it is up to the individual internal auditor to decide whether or not to make use of GAS as he/she deems fit" is coded as 1
- "The internal audit function has formalised and implemented procedures, standards, and documentation, and offers training that provide guidance to the

internal audit staff on how GAS and data analytics should be applied on an internal audit engagement" is coded as 2

Questions 4.7.1-4.7.4, 4.8.1-4.8.13, 5.9.1

- "Never" is coded as 1
- "Rarely" is coded as 2
- "Sometimes" is coded as 3
- "Often" is coded as 4
- "Always" is coded as 5

Question 6.1

- "Significantly dissatisfied: requires major improvement" is coded as 1
- "Dissatisfied: requires improvement" is coded as 2
- "Neither satisfied or dissatisfied: functional but not yet optimal" is coded as 3
- "Reasonably satisfied: however, some improvement may be required" is coded as 4
- "Very satisfied: no improvement required" is coded as 5

ANNEXURE K: CRONBACH ALPHA COEFFICIENTS FOR ALL LIKERT SCALED VARIABLES

20 Variables:	Q3_1 Q3_2 Q3_3 Q4_7_1 Q4_7_2 Q4_7_3 Q4_8_01 Q4_8_02 Q4_8_03 Q4_8_04 Q4_8_05 Q4_8_06 Q4_8_07 Q4_8_08 Q4_8_09 Q4_8_10 Q4_8_11 Q4_8_12 Q5_9_1 Q6_1

Simple Statistics							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
Q3_1	9	3.33333	1.00000	30.00000	2.00000	5.00000	Q3_1
Q3_2	9	1.66667	0.50000	15.00000	1.00000	2.00000	Q3_2
Q3_3	9	1.44444	0.72648	13.00000	1.00000	3.00000	Q3_3
Q4_7_1	9	2.22222	1.39443	20.00000	1.00000	5.00000	Q4_7_1
Q4_7_2	9	3.00000	1.00000	27.00000	2.00000	5.00000	Q4_7_2
Q4_7_3	9	2.88889	1.45297	26.00000	1.00000	5.00000	Q4_7_3
Q4_8_01	9	3.55556	0.88192	32.00000	2.00000	5.00000	Q4_8_01
Q4_8_02	9	3.66667	1.00000	33.00000	2.00000	5.00000	Q4_8_02
Q4_8_03	9	3.55556	1.01379	32.00000	2.00000	5.00000	Q4_8_03
Q4_8_04	9	2.66667	0.86603	24.00000	2.00000	4.00000	Q4_8_04
Q4_8_05	9	2.55556	1.01379	23.00000	1.00000	4.00000	Q4_8_05
Q4_8_06	9	3.11111	1.26930	28.00000	1.00000	5.00000	Q4_8_06
Q4_8_07	9	3.55556	1.13039	32.00000	2.00000	5.00000	Q4_8_07
Q4_8_08	9	3.11111	1.05409	28.00000	2.00000	5.00000	Q4_8_08
Q4_8_09	9	2.66667	1.22474	24.00000	1.00000	5.00000	Q4_8_09
Q4_8_10	9	3.55556	0.88192	32.00000	2.00000	5.00000	Q4_8_10
Q4_8_11	9	2.88889	1.16667	26.00000	2.00000	5.00000	Q4_8_11
Q4_8_12	9	2.55556	1.13039	23.00000	1.00000	4.00000	Q4_8_12
Q5_9_1	9	2.33333	1.00000	21.00000	1.00000	4.00000	Q5_9_1
Q6_1	9	2.44444	0.72648	22.00000	2.00000	4.00000	Q6_1

Cronbach Coefficient Alpha	
Variables	**Alpha**
Raw	0.949299
Standardized	0.949943

Cronbach Coefficient Alpha with Deleted Variable

Deleted Variable	Raw Variables: Correlation with Total	Raw Variables: Alpha	Standardized Variables: Correlation with Total	Standardized Variables: Alpha	Label
Q3_1	0.288162	0.952310	0.288074	0.953205	Q3_1
Q3_2	0.379143	0.950365	0.357034	0.952212	Q3_2
Q3_3	0.360278	0.950574	0.329774	0.952605	Q3_3
Q4_7_1	0.653601	0.947898	0.667325	0.947626	Q4_7_1
Q4_7_2	0.825227	0.944592	0.824906	0.945221	Q4_7_2
Q4_7_3	0.835225	0.944288	0.843367	0.944936	Q4_7_3
Q4_8_01	0.672145	0.946967	0.669687	0.947590	Q4_8_01
Q4_8_02	0.809589	0.944825	0.811652	0.945426	Q4_8_02
Q4_8_03	0.813026	0.944740	0.815352	0.945369	Q4_8_03
Q4_8_04	0.668116	0.947045	0.660738	0.947725	Q4_8_04
Q4_8_05	0.840875	0.944320	0.837458	0.945028	Q4_8_05
Q4_8_06	0.683363	0.946915	0.692359	0.947247	Q4_8_06
Q4_8_07	0.804901	0.944673	0.806077	0.945511	Q4_8_07
Q4_8_08	0.759369	0.945491	0.767204	0.946108	Q4_8_08
Q4_8_09	0.677206	0.946932	0.679899	0.947436	Q4_8_09
Q4_8_10	0.796806	0.945354	0.794588	0.945688	Q4_8_10
Q4_8_11	0.788197	0.944934	0.794636	0.945687	Q4_8_11
Q4_8_12	0.830191	0.944247	0.825874	0.945206	Q4_8_12
Q5_9_1	0.262024	0.952671	0.251387	0.953729	Q5_9_1
Q6_1	0.925855	0.944627	0.924339	0.943677	Q6_1

Pearson Correlation Coefficients, N = 9 Prob > |r| under H0: Rho=0										
	Q3_1	**Q3_2**	**Q3_3**	**Q4_7_1**	**Q4_7_2**	**Q4_7_3**	**Q4_8_01**	**Q4_8_02**	**Q4_8_03**	**Q4_8_04**
Q3_1	1.00000	-0.25000	-0.05735	-0.23905	0.25000	-0.05735	0.61419	0.50000	0.65760	0.00000
		0.5165	0.8835	0.5356	0.5165	0.8835	0.0785	0.1705	0.0542	1.0000
Q3_2	-0.25000	1.00000	-0.22942	0.47809	0.25000	0.63089	0.18898	0.25000	0.16440	0.28868
Q3_2	0.5165		0.5527	0.1930	0.5165	0.0685	0.6263	0.5165	0.6725	0.4512
Q3_3	-0.05735	-0.22942	1.00000	0.50728	0.17206	0.40789	-0.04336	0.05735	0.13201	0.26491
Q3_3	0.8835	0.5527		0.1633	0.6580	0.2758	0.9118	0.8835	0.7350	0.4909
Q4_7_1	-0.23905	0.47809	0.50728	1.00000	0.71714	0.69237	0.09035	0.32869	0.34387	0.79358
Q4_7_1	0.5356	0.1930	0.1633		0.0297	0.0387	0.8172	0.3878	0.3649	0.0107
Q4_7_2	0.25000	0.25000	0.17206	0.71714	1.00000	0.60222	0.56695	0.75000	0.73980	0.86603
Q4_7_2	0.5165	0.5165	0.6580	0.0297		0.0862	0.1114	0.0199	0.0227	0.0025
Q4_7_3	-0.05735	0.63089	0.40789	0.69237	0.60222	1.00000	0.54194	0.65957	0.55631	0.56293
Q4_7_3	0.8835	0.0685	0.2758	0.0387	0.0862		0.1318	0.0533	0.1198	0.1145
Q4_8_01	0.61419	0.18898	-0.04336	0.09035	0.56695	0.54194	1.00000	0.94491	0.86992	0.27277
Q4_8_01	0.0785	0.6263	0.9118	0.8172	0.1114	0.1318		0.0001	0.0023	0.4776
Q4_8_02	0.50000	0.25000	0.05735	0.32869	0.75000	0.65957	0.94491	1.00000	0.94529	0.43301
Q4_8_02	0.1705	0.5165	0.8835	0.3878	0.0199	0.0533	0.0001		0.0001	0.2443
Q4_8_03	0.65760	0.16440	0.13201	0.34387	0.73980	0.55631	0.86992	0.94529	1.00000	0.37966
Q4_8_03	0.0542	0.6725	0.7350	0.3649	0.0227	0.1198	0.0023	0.0001		0.3135
Q4_8_04	0.00000	0.28868	0.26491	0.79358	0.86603	0.56293	0.27277	0.43301	0.37966	1.00000
Q4_8_04	1.0000	0.4512	0.4909	0.0107	0.0025	0.1145	0.4776	0.2443	0.3135	
Q4_8_05	0.16440	0.41100	0.64117	0.78598	0.61650	0.81089	0.31068	0.45210	0.51351	0.66441
Q4_8_05	0.6725	0.2718	0.0627	0.0120	0.0770	0.0080	0.4158	0.2218	0.1574	0.0509
Q4_8_06	0.45957	0.26261	0.21087	0.26680	0.49240	0.61754	0.83129	0.82067	0.82029	0.15162
Q4_8_06	0.2133	0.4948	0.5860	0.4877	0.1781	0.0764	0.0055	0.0067	0.0068	0.6970
Q4_8_07	0.47919	0.14744	0.11839	0.30840	0.77407	0.65114	0.90558	0.95837	0.89685	0.46819
Q4_8_07	0.1918	0.7050	0.7616	0.4194	0.0144	0.0575	0.0008	<.0001	0.0010	0.2037
Q4_8_08	0.55340	0.55340	-0.07255	0.32127	0.59293	0.66200	0.73208	0.75104	0.75382	0.45644
Q4_8_08	0.1222	0.1222	0.8529	0.3992	0.0924	0.0521	0.0249	0.0197	0.0190	0.2168
Q4_8_09	0.00000	0.20412	0.60878	0.85391	0.71443	0.60878	0.07715	0.30619	0.36914	0.82496
Q4_8_09	1.0000	0.5983	0.0819	0.0034	0.0306	0.0819	0.8436	0.4229	0.3282	0.0062
Q4_8_10	0.33072	0.18898	0.15174	0.49693	0.85042	0.63949	0.83929	0.94491	0.86992	0.60010
Q4_8_10	0.3847	0.6263	0.6967	0.1735	0.0037	0.0637	0.0047	0.0001	0.0023	0.0876

Pearson Correlation Coefficients, N = 9 Prob > |r| under H0: Rho=0										
	Q3_1	**Q3_2**	**Q3_3**	**Q4_7_1**	**Q4_7_2**	**Q4_7_3**	**Q4_8_01**	**Q4_8_02**	**Q4_8_03**	**Q4_8_04**
Q4_8_11 Q4_8_11	0.67857 0.0445	0.35714 0.3454	0.06555 0.8669	0.32442 0.3944	0.64286 0.0618	0.58173 0.1003	0.67494 0.0461	0.71429 0.0306	0.79851 0.0099	0.45363 0.2200
Q4_8_12 Q4_8_12	0.03686 0.9250	0.36860 0.3290	0.57503 0.1053	0.70491 0.0339	0.66349 0.0514	0.87946 0.0018	0.40403 0.2808	0.51605 0.1550	0.46055 0.2122	0.72357 0.0276
Q5_9_1 Q5_9_1	-0.37500 0.3200	0.25000 0.5165	0.80296 0.0092	0.56773 0.1108	0.00000 1.0000	0.54486 0.1293	-0.23623 0.5406	-0.12500 0.7486	-0.08220 0.8335	0.14434 0.7110
Q6_1 Q6_1	0.28677 0.4544	0.45883 0.2141	0.28947 0.4499	0.75406 0.0189	0.86031 0.0029	0.76316 0.0167	0.54194 0.1318	0.74560 0.0211	0.81089 0.0080	0.66227 0.0520

Pearson Correlation Coefficients, N = 9 Prob > |r| under H0: Rho=0										
	Q4_8_05	**Q4_8_06**	**Q4_8_07**	**Q4_8_08**	**Q4_8_09**	**Q4_8_10**	**Q4_8_11**	**Q4_8_12**	**Q5_9_1**	**Q6_1**
Q3_1	0.16440 0.6725	0.45957 0.2133	0.47919 0.1918	0.55340 0.1222	0.00000 1.0000	0.33072 0.3847	0.67857 0.0445	0.03686 0.9250	-0.37500 0.3200	0.28677 0.4544
Q3_2 Q3_2	0.41100 0.2718	0.26261 0.4948	0.14744 0.7050	0.55340 0.1222	0.20412 0.5983	0.18898 0.6263	0.35714 0.3454	0.36860 0.3290	0.25000 0.5165	0.45883 0.2141
Q3_3 Q3_3	0.64117 0.0627	0.21087 0.5860	0.11839 0.7616	-0.07255 0.8529	0.60878 0.0819	0.15174 0.6967	0.06555 0.8669	0.57503 0.1053	0.80296 0.0092	0.28947 0.4499
Q4_7_1 Q4_7_1	0.78598 0.0120	0.26680 0.4877	0.30840 0.4194	0.32127 0.3992	0.85391 0.0034	0.49693 0.1735	0.32442 0.3944	0.70491 0.0339	0.56773 0.1108	0.75406 0.0189
Q4_7_2 Q4_7_2	0.61650 0.0770	0.49240 0.1781	0.77407 0.0144	0.59293 0.0924	0.71443 0.0306	0.85042 0.0037	0.64286 0.0618	0.66349 0.0514	0.00000 1.0000	0.86031 0.0029
Q4_7_3 Q4_7_3	0.81089 0.0080	0.61754 0.0764	0.65114 0.0575	0.66200 0.0521	0.60878 0.0819	0.63949 0.0637	0.58173 0.1003	0.87946 0.0018	0.54486 0.1293	0.76316 0.0167
Q4_8_01 Q4_8_01	0.31068 0.4158	0.83129 0.0055	0.90558 0.0008	0.73208 0.0249	0.07715 0.8436	0.83929 0.0047	0.67494 0.0461	0.40403 0.2808	-0.23623 0.5406	0.54194 0.1318
Q4_8_02 Q4_8_02	0.45210 0.2218	0.82067 0.0067	0.95837 <.0001	0.75104 0.0197	0.30619 0.4229	0.94491 0.0001	0.71429 0.0306	0.51605 0.1550	-0.12500 0.7486	0.74560 0.0211
Q4_8_03 Q4_8_03	0.51351 0.1574	0.82029 0.0068	0.89685 0.0010	0.75382 0.0190	0.36914 0.3282	0.86992 0.0023	0.79851 0.0099	0.46055 0.2122	-0.08220 0.8335	0.81089 0.0080
Q4_8_04 Q4_8_04	0.66441 0.0509	0.15162 0.6970	0.46819 0.2037	0.45644 0.2168	0.82496 0.0062	0.60010 0.0876	0.45363 0.2200	0.72357 0.0276	0.14434 0.7110	0.66227 0.0520

Pearson Correlation Coefficients, N = 9
Prob > |r| under H0: Rho=0

	Q4_8_05	Q4_8_06	Q4_8_07	Q4_8_08	Q4_8_09	Q4_8_10	Q4_8_11	Q4_8_12	Q5_9_1	Q6_1
Q4_8_05	1.00000	0.43173	0.46055	0.63685	0.87250	0.45049	0.69282	0.89685	0.65760	0.81089
Q4_8_05		0.2459	0.2122	0.0651	0.0021	0.2236	0.0386	0.0010	0.0542	0.0080
Q4_8_06	0.43173	1.00000	0.82280	0.55018	0.10721	0.71962	0.60026	0.47432	0.16413	0.61754
Q4_8_06	0.2459		0.0065	0.1248	0.7837	0.0288	0.0875	0.1970	0.6730	0.0764
Q4_8_07	0.46055	0.82280	1.00000	0.67607	0.33106	0.90558	0.71615	0.60870	-0.07372	0.72725
Q4_8_07	0.2122	0.0065		0.0456	0.3842	0.0008	0.0300	0.0819	0.8505	0.0264
Q4_8_08	0.63685	0.55018	0.67607	1.00000	0.41957	0.59761	0.92610	0.57116	-0.03953	0.74361
Q4_8_08	0.0651	0.1248	0.0456		0.2609	0.0892	0.0003	0.1082	0.9196	0.0216
Q4_8_09	0.87250	0.10721	0.33106	0.41957	1.00000	0.42433	0.49573	0.78251	0.51031	0.74927
Q4_8_09	0.0021	0.7837	0.3842	0.2609		0.2550	0.1747	0.0127	0.1604	0.0201
Q4_8_10	0.45049	0.71962	0.90558	0.59761	0.42433	1.00000	0.55345	0.52941	-0.09449	0.73704
Q4_8_10	0.2236	0.0288	0.0008	0.0892	0.2550		0.1221	0.1427	0.8089	0.0235
Q4_8_11	0.69282	0.60026	0.71615	0.92610	0.49573	0.55345	1.00000	0.62136	0.03571	0.80296
Q4_8_11	0.0386	0.0875	0.0300	0.0003	0.1747	0.1221		0.0741	0.9273	0.0092
Q4_8_12	0.89685	0.47432	0.60870	0.57116	0.78251	0.52941	0.62136	1.00000	0.58977	0.72725
Q4_8_12	0.0010	0.1970	0.0819	0.1082	0.0127	0.1427	0.0741		0.0946	0.0264
Q5_9_1	0.65760	0.16413	-0.07372	-0.03953	0.51031	-0.09449	0.03571	0.58977	1.00000	0.28677
Q5_9_1	0.0542	0.6730	0.8505	0.9196	0.1604	0.8089	0.9273	0.0946		0.4544
Q6_1	0.81089	0.61754	0.72725	0.74361	0.74927	0.73704	0.80296	0.72725	0.28677	1.00000
Q6_1	0.0080	0.0764	0.0264	0.0216	0.0201	0.0235	0.0092	0.0264	0.4544	

ANNEXURE L: SCORING CALCULATION FOR NUMBER OF STAFF MEMBERS IN THE DATA ANALYTICS TEAM WITHIN THE INTERNAL AUDIT FUNCTION

For the interval variable (question 3.4.1) where the respondents indicated the number of staff members in their data analytics teams the means and standard deviations were calculated and the following scores were allocated:

- If the number of staff members within their data analytics team is between 0 and the mean minus 2 times the standard deviations the score would be 1;
- If the number of staff members within their data analytics team is between the mean minus 2 times the standard deviations and mean minus 1 standard deviation the score would be 2;
- If the number of staff members within their data analytics team is between the mean minus the standard deviation and mean plus 1 standard deviation the score would be 3;
- If the number of staff members within their data analytics team is between the mean plus the standard deviation and mean plus 2 standard deviations the score would be 4;
- If the number of staff members within their data analytics team is more than the mean plus 2 times the standard deviations the score would be 5.

Take note that the assumption is made that the above mentioned variable will be normally distributed. This implies that 66.7% of the responses will fall in between one standard deviation from the mean; 95.0% of the responses will fall in between two standard deviations from the mean and 5% of the responses will fall more than two standard deviations from the mean. In other words, in a population of banks (refer to section 4.2) the number of specialists/data analysts would follow a normal distribution. It would suggest that more responses will be allocated around the central value and less at the ends.

It should further be noted that bank 4 had a much higher number of staff members within their data analytics team compared to the other banks. As a result, the variability of the data is much higher, and if the above mentioned scoring is followed, it would give negative values for the lower levels. Thus, there is not a range to score a point to the value of 1, as the values are negative for the lower levels, and the scoring can therefore either be 0, 2, 3, 4 or 5 as indicated in section 4.5.1.

ANNEXURE M: SCORING CALCULATION FOR NUMBER OF DATA SPECIALISTS AND/OR ERP SYSTEMS SPECIALISTS WITHIN THE INTERNAL AUDIT FUNCTION

For the interval variable (question 3.5.1) where the respondents indicated the number of data specialists, and/or ERP systems specialists; the means and standard deviations were calculated and the following scores were allocated:

- If the number of staff members within their data analytics team is between 0 and the mean minus 2 times the standard deviations the score would be 1;
- If the number of staff members within their data analytics team is between the mean minus 2 times the standard deviations and mean minus 1 standard deviation the score would be 2;
- If the number of staff members within their data analytics team is between the mean minus the standard deviation and mean plus 1 standard deviation the score would be 3;
- If the number of staff members within their data analytics team is between the mean plus the standard deviation and mean plus 2 standard deviations the score would be 4;
- If the number of staff members within their data analytics team is more than the mean plus 2 times the standard deviations the score would be 5.

Take note that the assumption is made that the above mentioned variable will be normally distributed. This implies that 66.7% of the responses will fall in between one standard deviation from the mean; 95.0% of the responses will fall in between two standard deviations from the mean and 5% of the responses will fall more than two standard deviations from the mean. In other words, in a population of banks (refer to section 4.2) the number of specialists/data analysts would follow a normal distribution. It would suggest that more responses will be allocated around the central value and less at the ends.

It should further be noted that bank 4 had a much higher number of data specialists within their internal audit function compared to the other banks. As a result, the variability of the data is much higher, and if the above mentioned scoring is followed, it would give negative values for the lower levels. Thus, there is not a range to score a point to the value of 1, as the values are negative for the lower levels, and the scoring can therefore either be 0, 2, 3, 4 or 5 as indicated in section 4.5.1.