THE USE OF GENERALISED AUDIT SOFTWARE BY INTERNAL AUDIT FUNCTIONS IN A DEVELOPING COUNTRY: THE PURPOSE OF THE USE OF GENERALISED AUDIT SOFTWARE AS A DATA ANALYTICS TOOL

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Abstract

This article explores the purpose of the use of generalised audit software as a data analytics tool by internal audit functions in the locally controlled banking industry of South Africa. The evolution of 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 such practice in the present technological, data-driven era will soon render such an internal audit function obsolete. The research results indicate that respondents are utilising GAS for a variety of purposes but that its frequency of use is not yet optimal and that there is still much room for improvement for tests of controls purposes. The top five purposes for which the respondents make use of GAS often to always during separate internal audit engagements are: (1) to identify transactions with specific characteristics or control criteria for tests of control purposes; (2) for conducting full population analysis; (3) to identify account balances over a certain amount; (4) to identify and report on the frequency of occurrence of risks or frequency of occurrence of specific events; and (5) to obtain audit evidence about control effectiveness.

Keywords: Banking Industry, Big Data, Computer Assisted Audit Techniques, Generalised Audit Software, Internal Audit, Tests of Controls

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 had a significant impact on the banking industry. One of the main impacts of technological innovation, amongst others, was the ease of processing and transmission of information that it introduced. Banks can now effortlessly market their products and services on a globally networked platform. In addition, the development of information technology has resulted in the transformation of banks' product ranges, its service channels and the types and packaging of its services (Campanella, Peruta & Giudice, 2015). 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 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. The term "big data" 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, 2016b: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, 2016b:7). Big data 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, 2016a). 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 its' big data (IIA, 2015b:16).

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. The IIA's Research Foundation (2016b: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. 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. The traditional methods of collecting audit evidence (for example, the conduct of interviews, the completion of questionnaires, and by testing controls on a sample basis) 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, 2016b:1). In addition, the IIA 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, 2016c:7). 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* 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 research findings in this article form part of the results of an extensive study done on the use of GAS by internal audit functions in the South African banking industry, performed in fulfilment of a PhD degree in Auditing. This article highlights the research findings with regard to the different uses of GAS as a data analytics tool by the internal audit functions in the South African banking industry and is the second in a series of two articles. The first article highlighted the research findings with regard to the maturity of the use of GAS by internal audit functions in the South African banking industry.

The most prominent use of technology-enabled tools and techniques, namely the use of computer assisted audit techniques (CAATs) and specifically generalised audit software (GAS), is the focus of this article (see section 2). In the next section the research objective and methodology is discussed, and this is followed by a literature review, empirical findings and a conclusion.

2. RESEARCH OBJECTIVE AND METHODOLOGY

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". This article is guided by the following **research objective**: *To explore and identify the purposes for which GAS as a data analytics tool is presently being used by internal audit functions in the locally controlled South African banking industry.*

The primary method of data collection used in this article was by means of a structured questionnaire (quantitative method), which was then followed up with a semi-structured telephonic interview, but only in cases where further clarity was sought from the respondents (qualitative method). The quantitative data, for the purposes of this article, was analysed through the use of descriptive statistics. The structured questionnaire (refer to Smidt (2016:306) also gathered additional qualitative data through the use of a limited number of open ended questions. The qualitative data provided additional insight regarding the current frequency of use (i.e., level of maturity) in the use of GAS, the second article in this series provides insight into the reasons for including GAS in their respective audit methodologies.

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.). The research population therefore consisted of Chief Audit Executives (CAEs) of in-house internal audit functions from the ten (10) locally controlled banks that were at that stage (2016) registered with the South African Central Bank (Reserve Bank), and that were thus permitted to conduct the business of a bank in South Africa (a list of these 10 locally controlled banks is included in Annexure A). The locally controlled banks were specifically selected as their internal audit methodologies and procedures have been developed and maintained by their respective South African head office internal audit functions, in compliance with South African legislation. Internal audit methodologies used in the locally operating foreign banks have been developed and are maintained at the banks' international head offices, and were therefore excluded from this research because of the diversity of jurisdictions and legislation governing these functions.

The total number of questionnaires returned was nine from the ten banks. The questionnaires were followed up by a semi-structured interview with the nine participating CAEs (but only in cases where further clarity was sought from the respondents).

3. LITERATURE REVIEW

3.1. Computer assisted audit techniques (CAATS) – an overview

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 or uses of CAATs, with specific emphasis on GAS as the primary (most frequently used) CAAT, is discussed in section 3.2.1). 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. Of these five categories GAS is the most frequently used CAAT and is also the focus of this article (as was mentioned in section 2) (Braun & Davis, 2003:725; Debreceny, Lee, Neo & Toh, 2005:605; Kim, Mannino & Nieschwietz, 2009:215; Lin & Wang, 2011:777; Mahzan & Lymer, 2014:328; IIA, 2016b:56). Section 3.2 provides a discussion of the use of GAS by internal auditors.

The use of CAATs enables internal audit functions to perform in-depth analyses of organisations' data. Soileau, Soileau & Sumners (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 above), 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 (2016b: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.

The focus of this article is on the purpose of the use of GAS by internal audit functions in the locally controlled South African banking industry (as was stated in section 2), and GAS is therefore discussed in more detail in the next section.

3.2. 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 during the conduct of internal audit engagements (IIA, 2016c:7). Among these technology-based tools, and specifically required by the Standards, is the use of GAS. As mentioned in section 3.1, 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 (refer to section 3.1). 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 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 (Lin & Wang, 2011:777; Ahmi & Kent, 2013:90; Mahzan & Lymer, 2014:338).

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", 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. 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, 2016a: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.

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 (2013:2)) 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 (2016b: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 (2015:12), 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 above, 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 3.2.1. 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 3.2.2.

3.2.1. Functions and advantages of GAS as contributing factors for the adoption by internal audit functions

The adoption and use of GAS offers a number of data analysis functions to internal auditors. Table 1 provides a summary of the most common functions associated with the use of GAS (purpose of the use of GAS). This summary has been compiled from literature on GAS and various other auditing perspectives (Debreceny *et al.,* 2005:608; Janvrin, Bierstaker & Lowe, 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; Zaiceanu, Hlaciuc & Lucan, 2015:601; Ahmi, 2012:43; Cangemi, 2016:1; Elefterie & Badea, 2016:305; IIA, 2016b:58).

Table 1. 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 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 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

Reviewing the information in Table 1, 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. 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. 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.

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;
- 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; Zaiceanu *et al.,* 2015:601; Elefterie & Badea, 2016:305; IIA, 2016b: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 3.2. 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 above as some of the contributing drivers for adopting GAS as an essential tool in their audit approaches. Table 2 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 2. 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.
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 audit software use by internal auditors	• 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)*
2015	Protiviti	Changing trends in internal audit and advanced analytics	• Testing support for specific audits; • Sample selection; • Risk assessment; • Audit planning; and • Continuous monitoring.
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 • More audits are capable of being performed.

Reviewing the information in Table 2 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 that internal audit provides broader (extended) audit coverage in an effective and efficient manner (IIA, 2014:1; PwC, 2014:2; PwC, 2015:17; Tusek, 2015:188). 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.

3.2.2. Limitations and disadvantages of GAS precluding the adoption by internal audit functions

Despite the number of advantages and functionalities that the use of GAS may offer (as mentioned in section 3.2.1) 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 2) 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.

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, 2013:3) 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 (2016b: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 above 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 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 above.

While the factors and limitations highlighted by internal audit functions above 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.

4. EMPIRICAL FINDINGS

4.1. The purposes for which the internal audit functions make use of GAS

The frequency of the use of GAS by internal audit functions is a strong indicator of the purpose of the use of GAS by such internal audit functions. Various studies (Coetzee & Lubbe, 2014:119; IIA, 2015b:10; Motubatse, van Staden, Steyn & Erasmus, 2015:271; Sun, Alles & Vasarhelyi, 2015:177) 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, various auditing - and GAS-related research publications (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; Zaiceanu *et al.,* 2015:601; Elefterie & Badea, 2016:305; IIA, 2016b:58) 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. Table 3 (refer to Smidt (2016:329) provides a summary of the frequency and the various purposes of the use of GAS during the systematic phases of the internal audit approach.

Table 3. The frequency and purpose of the use of GAS during the systematic phases of the internal audit approach

Variables	*Frequency*	*Number of responses*	*Percentage out of total responses (n=9)*
Phase 1:Annual audit planning			
1.1 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%
Phase 2:Engagement planning			
1.2 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%
Phase 3:Fieldwork			
1.3 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%
1.4 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%
1.5 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%

Variables	*Frequency*	*Number of responses*	*Percentage out of total responses (n=9)*
1.6 Frequency internal audit function make use of GAS for risk identification purposes.	Never	0	0.0%
	Rarely	5	55.6%
	Sometimes	2	22.2%
	Often	2	22.2%
	Always	0	0.0%
1.7 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%
1.8 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%
1.9 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%
1.10 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%
	Always	1	11.1%
1.11 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%
1.12 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%
1.13 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%
1.14 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%
Phase 4:Monitoring and follow-up			
1.15 Frequency of use of GAS to 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.	Never	2	22.2%
	Rarely	2	22.2%
	Sometimes	1	11.1%
	Often	3	33.3%
	Always	1	11.1%

The results in Table 3 (refer to variable 1.1), 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%) indicated that GAS was *never to rarely* used to conduct risk-based annual audit planning. There were only 22.2% of the respondents that indicated 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%) indicating that GAS was *rarely to sometimes* used to conduct risk based engagement audit planning (refer to variable 1.2 in Table 3). However, 22.2% of the respondents 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%) indicated that GAS was *rarely* used for risk identification purposes during individual audit engagements (refer to variable 1.6 in Table 3). There were 22.2% of the respondents that

indicated they *sometimes* use GAS for this purpose, and also another 22.2% that 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 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 internal audit engagement. A tendency to use GAS more frequently for specific purposes was also noticeable as can be seen from the summary of results displayed in Table 1.3 (refer to variables 1.3 – 1.14). The following results refer to the frequency of the use of GAS during the conduct 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 indicated rarely, 33.3% indicated sometimes, 33.3% indicated often and 22.2% indicated always) (refer to variable 1.4 in Table 3).
- For conducting full population analysis (22.2% of the respondents indicated rarely, 22.2% indicated sometimes, 33.3% indicated often and 22.2% indicated always) (refer to variable 1.9 in Table 3).
- To identify account balances over a certain amount (11.1% of the respondents indicated rarely, 44.4% indicated sometimes, 22.2% indicated often and another 22.2% indicated always) (refer to variable 1.5 in Table 3).
- 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 indicated rarely, 33.3% indicated sometimes, 44.4% indicated often and 11.1% indicated always) (refer to variable 1.12 in Table 3).
- To obtain audit evidence about control effectiveness (11.1% of the respondents indicated rarely, 33.3% indicated sometimes, 44.4% indicated often and 11.1% indicated always) (refer to variable 1.3 in Table 3).
- For selecting random samples for tests of control purposes from key electronic files (11.1% of the respondents indicated never, 22.2% indicated rarely, 22.2% indicated sometimes, 33.3% indicated often and 11.1% indicated always) (refer to variable 1.8 in Table 3).
- To re-perform procedures (33.3% of the respondents indicated rarely, 33.3% indicated sometimes, 22.2% indicated often and 11.1% indicated always) (refer to variable 1.10 in Table 3).
- 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 indicated rarely, 11.1% indicated sometimes, 22.2% indicated often and 11.1% indicated always) (refer to variable 1.13 in Table 3).
- For risk identification purposes (55.6% of respondents indicated rarely, 22.2% indicated sometimes and 22.2% indicated often) (refer to variable 1.6 in Table 3).
- For the generation of exception reports through continuous auditing (11.1% of the respondents indicated never, 44.4% indicated rarely, 22.2% indicated sometimes, 11.1% indicated often and another 11.1% indicated always) (refer to variable 1.11 in Table 3).
- The results of the data analysis are used to identify trends and to predict future risk events (22.2% of the respondents indicated never, 22.2% indicated rarely, 33.3% indicated sometimes and 22.2% indicated often) (refer to variable 1.14 in Table 3).
- To evaluate fraud risks (11.1% of the respondents indicated never, 44.4% indicated rarely, 22.2% indicated sometimes and 22.2% indicated often) (refer to variable 1.7 in Table 3).

Reviewing the results above (with specific reference to variables 1.12, 1.13 and 1.14) it is evident that the locally controlled banking industry's internal auditors' "line of sight" 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 variable 1.12, (*"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 (Deloitte, 2013:3; IIA, 2016b:14). 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 variable 1.13 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). Reviewing the responses to variable 1.14, 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 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. The use of GAS can also be used for this purpose: 22% of the respondents *never* store audit-specific data in GAS for monitoring and follow-up purposes; 22.2% indicated that audit-specific data is *rarely* stored in GAS for monitoring and follow-up purposes; 11.1% indicated it is *sometimes* stored in GAS; 33.3% indicated that audit-specific data is *often* stored in GAS for monitoring and follow-up purposes, and 11.1% indicated that it is *always* stored in GAS to support and inform monitoring and following-up on previously reported audit findings at their banks (refer to variable 1.15 in Table 3). 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 next section contains concluding remarks regarding the purpose of the use of GAS by internal audit functions within the locally controlled South African Banking industry.

5. CONCLUSION

The empirical research results indicate that respondents are utilising GAS for a variety of purposes during the conduct of an internal audit engagement but that its frequency of use is not yet optimal and that there is still much room for improvement for tests of controls purposes. It is also not sufficiently used in all phases of an internal audit engagement. 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.

To reiterate, the most important findings identified during the empirical analysis are:

- 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 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;
- For conducting 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.

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.

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