SAI Automation and Technology Adoption

September 2022

EXECUTIVE SUMMARY

The primary aim of this study was to establish the key factors that could be used by SAIs in deciding on technologies to adopt and the impact of automation in audit. This was motivated by a failure of SAIs to provide technological support to its employees especially during the pandemic period.

To achieve the main aim of the study, a quantitative approach was adopted, and associated data was gathered using a questionnaire. Management and other personnel at SAIs provided their perceptions on key factors that could be used by SAIs in deciding on technologies to adopt and the effect of technology on quality of audits.

The findings indicated that technological compatibility, technological complexity, technological cost benefit, top management commitment and professional body support are critical elements that must be considered in deciding on new technology to be adopted by SAIs. The study also found that quality of audits is positively influenced by adoption of technologies.

The conclusions on the research objectives were:

- ✓ Technological factors have a significant influence on the technologies SAIs adopt for audits.
- ✓ Organisational factors have no significant influence on the technologies SAIs adopt for audits.
- ✓ Environmental factors have no significant influence on the technologies SAIs adopt for audits.
- ✓ Voluntariness does not have an impact on the relationship between government regulations and adoption of technology.
- ✓ Voluntariness has a significant impact on the relationship between complexity of clients' information systems and professional body affiliation/support and SAIs' decision to adopt technology.
- ✓ Audit automation has significant influence on quality of audit.

Further, the study revealed that adopting technologies in SAIs increased productivity, the SAIs adopted less complex technology, the benefits of using technology outweighed its initial investment cost and top management showed commitment to the rollout of new technologies. A budget to support new technologies in terms of making available IT resources, IT facilities, training staff and providing technical support was also considered important.

To ensure the success of new technology adoption, it is therefore advisable for SAIs' establishments to consider several important aspects. Top management is advised to provide steadfast support, guidance and leadership that can guarantee project success. SAIs are advised to select appropriate technologies that are compatible or can be integrated with the clients being audited. An

understanding of what other SAIs are using, complexity of clients' information systems, and vendor systems is essential. Investing in technologies that bring less risk in the day-to-day running of operations should remain a priority of SAIs.

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ACRONYMS

AFROSAI-E	African Organisation of English-speaking Supreme Audit Institutions
ICBF	Institutional Capacity Building Framework
ICT	Information and communications technology
IDEA	Interactive data extraction and analysis
IFMIS	Integrated Financial Management Information System
INTOSAI	International Organisation of Supreme Audit Institutions
IS	Information systems
ISSAI	International Standards of Supreme Audit Institutions
IT	Information technology
JS	JavaScript Object Notation
MS	Microsoft
SAI	Supreme Audit Institution
SDG	Sustainable Development Goal
WGISAM	Working Group on Information Systems Audit and Management
XML	Extensible Markup Language

1 INTRODUCTION

1.1 Background

The 15th Governing Board meeting of AFROSAI-E held in Rwanda recommended the establishment of an AFROSAI-E Working Group on Information Systems Audit and Management (WGISAM). This working group would enable the region to exchange information on Information Systems (IS) security in the region. The formation of the WGISAM was motivated by the fast-growing technological advancements that presented a challenge to IS audits in SAIs and the increase in cybersecurity issues reported across the globe in the last few years.

The objectives of the working group are:

- ✓ To deliberate on topics relating to Information Systems (IS) Audit and Information Systems (IS) Management affecting SAIs in AFROSAI-E.
- ✓ To research and actively discuss emerging trends and innovations in IS auditing and security; and advise AFROSAI-E member SAIs on their value proposition when appropriate.
- ✓ To strengthen a shared vision among AFROSAI-E members and enhance wide cooperation among SAIs in IS audit and management.
- ✓ To develop guidelines that support capacity-building activities in IS audit and management.
- ✓ To collaborate with the INTOSAI WGITA and other relevant groups.

The research subgroup, with the help of AFROSAI-E members, identified various topics for research in the broad areas of IT Audit, IT Risk Management, Emerging IT Trends, IS Security and Networks, Business Intelligence and Big Data, Database Management and Storage, IT Computer Infrastructure and Platform Services and the Digital Workplace.

The research topics and areas are continually being relooked to ensure they are of relevance to the SAIs in the region, and INTOSAI in general. The topic of automation and technology selection was selected by AFROSAI-E's WGISAM due to its impact on the various research focus areas. For instance, information security of SAIs will be largely dependent on the SAIs' automation or technologies they are adopting. Further, given the fast paced changing digital world, it is important that SAIs should have a deliberate response to technology. SAIs are required to be responsive to changing environments and emerging risks if they are to live the principles of INTOSAI P-12 – The Value and Benefits of Supreme Audit Institutions.[1]

[1] ISSAI.Org. 2019. INTOSAI P-12 The Value and Benefits of Supreme Audit Institutions – making a difference to the lives of citizens. ISSAI.Org: https://www.issai.org/wp-content/uploads/2019/08/INTOSAI-P-12.pdf. Retrieved May 2021

1.2 Problem statement

The world is currently living in an industrial revolution that is digitally driven. This Fourth Industrial Revolution (4IR) is characterised by the convergence and complementarity of emerging technological domains, including nanotechnology, biotechnology, new materials and advanced digital production (ADP) technologies.[2] 4IR is fundamentally changing the world and technology within which the SAIs work.

The Sustainable Development Goals (SDGs) which were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity[3] also place importance on technology. SDG 9, INDUSTRY, INNOVATION AND INFRASTRUCTURE, recognizes that investment in infrastructure and innovation are crucial drivers of economic growth and development.

On the African continent, the quest for digital development and technology inclusion has been seen on many fronts. Many countries are implementing strategies to ensure they keep pace with technology. One notable step has been the adoption of the Smart Africa Manifesto which led to the development of SMART Africa. SMART Africa is a commitment from African Heads of State and Government to accelerate sustainable socio-economic development on the continent, ushering Africa into a knowledge economy through affordable access to broadband and usage of information and communications technologies.[4]

SAIs are mandated to, among other things, carry out audits to ensure that government and public sector entities are held accountable for their stewardship over, and use of, public resources.[1] Further, they are to report on audit results, thereby enabling the public to hold government and public sector entities accountable. The mandates of SAIs are expected to be delivered even in the technologically changing environments in which SAIs are operating. SAIs are therefore expected to be resilient and adopt as well as adapt to the technologies.

To be able to consistently deliver on their mandate, SAIs need to be deliberate in their automation and technology selection. Digital transformation is imperative. This is both for managing their operations and use in audit. To be effective, digital transformation must build on an IT foundation that ensures reliable

[2] Lavopa, A. & Delera, M. 2021. Industrial Analysis Forum: What is the Fourth Industrial Revolution. https://iap.unido.org/articles/what-fourth-industrial-revolution. Retrieved 7 October 2021

[3] United Nations Development Program. 2021. Sustainable Development Goals. https://www.undp.org/sustainable-development-goals#industry-innovation-and-infrastructure. Retrieved 30 September 2021

[4] Smart Africa. 2021. https://smartafrica.org/who-we-are/. Retrieved 3 October 2021

and sustainable outcomes. An unprepared organisation is likely to see its digital transformations flounder.[5]

This Moscow declaration[6] encourages SAIs to nurture the auditors of the future. The auditor needs to be deliberately equipped with the right tools. "With proper application of information technology and better audit methods, we can improve the lives of our citizens."—Hu Zejun, Auditor General, National Audit Office of the People's Republic of China (CNAO).[7]

In order to fulfil its mandate, the SAI must have means and ways to access client information for their audits. During and after the COVID-19 pandemic, auditors were forced to work remotely. Most SAIs struggled with access to information and were not able to connect to systems when auditing.[8] Although this was partly attributed to the infrastructure levels of countries' information systems, it may also indicate that SAIs have not automated, nor selected their technologies well. SAIs have been automating and selecting technologies but the remote working model forced by the pandemic showed SAIs that they were not prepared technologically.

AFROSAI-E members conduct an annual self-assessment using the AFROSAI-E Institutional Capacity Building Framework (ICBF). Their answers to a few questions in the ICBF give a perspective of the level of SAI automation.[9]

- ✓ 12 of the 26 member countries have not implemented a management information system (MIS), which includes financial and performance information and reporting. The average score in this domain is 2,62. The aim for the region is an average score of 3 out of 5 in the medium term.
- ✓ 18 of the 26 member countries are not using an electronic audit management system. The average regional score in this domain is 2,15, which also falls short of the level 3 aim.
- ✓ 16 of the 26 member countries are not making effective use of appropriate computer-assisted audit techniques (CAATS) to support their audit work. The average regional score in this domain is 2,15, with an average score of 3 also being the target for the region.

The automation and technology selected by SAIs do clearly matter from a mandate perspective and the expectations formulated through the principles of ISSAI P-12. Further, compliance with government regulations, such as the retention period for information relating to audits, is facilitated by technology.

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[5] Pearce, G. 2021. Technology Modernization, Digital Transformation Readiness and IT Cost Savings, ISACA Journal https://www.isaca.org/resources/isaca-journal/issues/2021/volume-5/technology-modernization-digital-transformation-readiness-and-it-cost-savings. Retrieved 30 August 2021

[6] INTOSAI JOURNAL. Summary of the Moscow Declaration (2019). http://intosaijournal.org/summary-of-the-moscow-declaration/. Retrieved May 2021

[7] INTOSAI JOURNAL. Using IT To Develop Public Administration. 2019. http://intosaijournal.org/using-it-to-develop-public-administration/. Retrieved August 2021

[8] AFROSAI-E. 2020. Resilience of SAIs during COVID-19. Pretoria: AFROSAI-E

[9] AFROSAI-E. 2021. 2020 State of the Region ICBF Self Assessment Report. Pretoria: AFROSAI-E

Currently, technology is moving at a fast pace and SAIs need to ensure that they not only automate, but that they automate correctly. The region needs insight into how SAIs select technology so that the larger number of SAIs that are yet to embark on this journey may learn key lessons in this regard.

Audit institutions should consider improving audit quality such as: conducting effective quality reviews of audits, remediating findings by obtaining the audit evidence necessary to form an opinion on the financial report, and identifying root causes of findings from their own quality reviews and audit inspections. Improving audit automation is a key step to provide better quality audit reports. Methods for improvement need to be clearly stipulated to give direction on how they are going to be implemented.

The research problem is that critical factors that must be taken into consideration in technology adoption (deliberate or forced) particularly at AFROSAI are unknown. Similarly, associated risk assessment methods and how these influence the quality of audit work are still undiscovered.

1.3 Objectives of the theme study

The primary objective of this study was to establish the key factors that have been used by SAIs in deciding on technologies to adopt and the impact of automation in audit.

The **sub-objectives** of the study were to determine whether:

i. Technological factors influence the technologies SAIs adopt for audits.
ii. Organisational factors influence the technologies SAIs adopt for audits.
iii. Environmental factors influence the technologies SAIs adopt for audits.
iv. Voluntariness significantly moderates the relationship between government regulations and SAIs' decision to adopt technology.
v. Voluntariness significantly moderates the relationship between professional body affiliation/support and SAIs' decision to adopt technology.
vi. Audit automation influences quality of audit.

1.4 Research questions

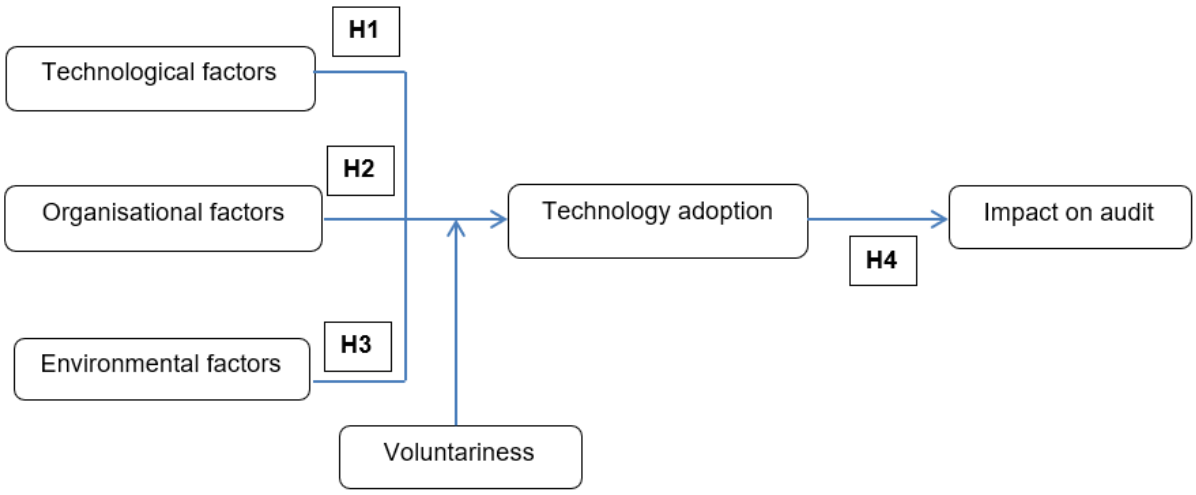
The study aims to answer the following research questions:

- ✓ Do technological compatibility, technological complexity and technological cost benefit influence the technologies SAIs adopt for audits?

- ✓ Do top management commitment, SAI employees' competence and size of SAIs influence the technologies SAIs adopt for audits?
- ✓ Do government regulations, complexity of clients' IS systems and professional body affiliation/support influence the technologies SAIs adopt for audits?
- ✓ Does ability to volunteer significantly moderate the relationship between government regulations and SAIs' decision to adopt technology?
- ✓ Does ability to volunteer significantly moderate the relationship between the influence of professional body affiliation/support and SAIs' decision to adopt technology?
- ✓ Do audit automation and technology influence quality of audits?

1.5 Analytical model of study

The analytical model of the study is shown in the figure below.



1.6 Significance of the study

The significance of the research is:

- ✓ INTOSAI P-12 demonstrates ongoing relevance to citizens and being responsive to changing environments and emerging risks.
- ✓ In current (COVID-19 pandemic) times when SAIs have been adopting technologies to aid remote work, the research will assist SAIs in the considerations to be made when selecting technologies.
- ✓ The study will show how automation can be useful in audits.

The expected results of the study are:

- ✓ A research paper contributing to current literature for AFROSAI-E and the INTOSAI community.
- ✓ A paper highlighting key considerations for SAIs when deciding on automation.

1.7 Timelines and key project milestones

The table below shows the research milestones.

Table 1: Study project plan

Activity	Responsibility	Date
1. Assignment of tasks to subgroup members	Chair	May 2021
2. Initial review of area and literature review	WGISAM research team	May to June 2021
3. Training in research methods	Research team	August 2021
4. Review of research paper structure and methods	Refinement team	September 2021
5. Development of research tool	Chair	January 2022
6. Testing of research tool (questionnaire)	Tool team	January 2022
7. Review of research	Trainer	January 2022
8. Communication to SAIs and distribution of questionnaire	AFROSAI-E	February 2022
9. Launch of study and online seminar	AFROSAI-E	February 2022
10. Administration of research instrument and field work	AFROSAI-E	February 2022
11. Data analysis and research writing	WGISAM research team	March to June 2022
12. Reviews and finalisation	WGISAM research team	June to July 2022
13. Final paper	AFROSAI-E	September 2022

2 LITERATURE REVIEW

2.1 Responsiveness to changing environments and emerging risks

INTOSAI P-12 calls on SAIs to be responsive to changing environments and emerging risks.[1] "Among supreme audit institutions (SAIs), there is a shared recognition that they need to respond to the challenge posed by governments increasing their use of sophisticated IT to manage and deliver their policies and programs".[10] This use of IT in government is prevalent in the AFROSAI-E region with 22 member countries recording financial transactions on an Integrated Financial Management System (IFMIS).[9]

Currently, only 10 (38%) of AFROSAI-E member SAIs are making effective use of appropriate CAATS to support their audit work.[9] Currently most data analyses done by SAIs are on structured data sources of ERP systems. Tools such as IDEA, Excel and ACL are used to do this analysis on financial transactional information or log files that are structured.

Principle 11 of INTOSAI P-12 further calls for SAIs to strive for service excellence and quality in their audit work. The World Bank contended that IT-based methods and procedures create the opportunity for SAIs to improve the quality, efficiency and effectiveness of their audits. Further, the experience to date of SAIs in responding to the challenges of the COVID-19 pandemic shows the opportunity that remote working coupled with the ingenuity of professional auditors can create to improve productivity and encourage innovation and new working methods.[10]

In the AFROSAI-E region, many SAIs commented that the COVID-19 pandemic contributed to delays in the timely completion of audits, because they encountered challenges in terms of technological infrastructure and remote working procedures.[9]

2.2 Technology adoption

Technology adoption is the successful integration of a new technology into the business operations of an organisation. It is a systematic approach to implementing technology to ensure that all appropriate teams in the organisation utilize the new technology.[11]

Technology adoption therefore means more than just using technology. It embraces the fullest use of the technology in question for the purpose of gaining the fullest benefit. Thus, when a SAI adopts new

[10] The World Bank. 2021. Supreme Audit Institutions' Use of Information Technology Globally for More Efficient and Effective Audits
[11] Jiban Khunta. 2019. Theory and practices of business intelligence in healthcare. DOI 10, 4018/978-1-7998

technology, the SAI needs to use it to its fullest potential to realize the full benefits of using such a new system. However, lack of training and IT skills in organisations will result in a limited use of IT technology and lack of success in reaping benefits from computer hardware and software (IT technology) in organisations.[12]

2.2.1 Phases in technology adoption

Technology adoption is not a one-off activity/task, it is an ongoing process with several phases including notable phases such as:[13]

- ✓ Selection: Institutions that need to adopt new technology in line with national strategy and organisational objectives must first select the specific technology they wish to adopt, based on their business requirements and needs. The selection phase of the adoption process includes an assessment of institutional/organisational needs and analysis to appropriately identify the technology that can best meet the business needs/problems of the institution.
- ✓ Planning: Upon selecting a particular technology, plans must be put in place for its implementation. This calls for the review of the existing infrastructure, staff and processes in line with changes that may be needed for the purpose of adopting the new technology.
- ✓ Communication: Having settled on the technology to adopt and having set up plans for the implementation, it is important to engage in frequent and constant communication with the people (staff) who will be implementing the new technology. Communication is therefore one of the most critical aspects/components of the change management process. It is more of an on-going need rather than a static phase of the adoption process.
- ✓ Training**:** Training of staff before the official launch of the new technology is required to make users confident, efficient and capable of using the product or the new technology.
- ✓ Testing and deployment: Preceding the nationwide rollout of the new technology, it is important to test within a small group (beta group) in the institution/organisation. Lessons learnt from the testing would be employed to better/correct the system for large-scale rollout countrywide.
- ✓ Institution-wide rollout: A country-wide rollout can be embarked upon based on successful test results.
- ✓ Monitoring: One of the key factors worth considering in technology adoption is the monitoring of progress and effective functioning of the technology with the view to identifying problem issues and solving them in good time.

[12] Brown, P.C., Roediger, HIL III & McDaniel, M.A. 2014. Make it stick: the science of successful learning. Belknap Press.

[13] Altadonna, N. 2020. Technology Adoption Explained https://www.apty.io/blog/technology-adoption-explained. Retrieved October 2021

2.2.2 Technology adoption life cycle

Most often, institutions and companies face the challenge of making a new technology or innovation to enter the mainstream market or work environment and be fully accepted and embraced by all. Sociologists describe this end with the term "crossing the chasm". The question therefore is how exactly do new technologies/innovations "cross the chasm" and attain employees' adoption of the product? The simple answer is by moving through the various stages of the life cycle of the technology.

There are four stages in the adoption process of a new technology. These are:[14]

- ✓ Complacency: This is a stage where individuals learn about a new technology/tool but pay little or no attention to it. They rarely consider it as a replacement of an already existing solution/process.
- ✓ Ridicule: The state of ridicule occurs where new technology does not immediately fail or disappear but people in the organisation begin to ridicule those who suggest its viability.
- ✓ Criticism: The stage of criticism surfaces when many more people accept the new technology and those committed to the older solution start to criticize it, searching for ways to compare it unfavourably with what they are used to.
- ✓ Acceptance: The stage where the new technology gains broad acceptance even by its critics.

2.3 Audit and automation

Public-sector auditing is a systematic process of objectively obtaining and evaluating evidence to determine whether information or actual conditions conform to established criteria (INTOSAI 100, 2019). This public-sector auditing is conducted by Supreme Audit Institutions (SAIs). SAIs generally audit and report on the stewardship and performance of government policies, programmes or operations.[15] Principles related to the audit process are guided by ISSAI 100.

To achieve their objectives, SAIs need to adapt audit methods to be in line with the progress of the sciences and techniques relating to financial management.[16] This is because governments are investing a lot of money in information and technology (IT) due to the benefits that accrue to their operations and service delivery.[17]

[14] Omar M. Khateeb. 2017. https://omarmkhateeb.medium.com/the-4-stages-to-adoption-inside-the-chasm-6c9c19e4375 <Online accessed 26 October 2021>

[15] ISSAI.Org. 2019. ISSAI 100 – Fundamental principles of Public-Sector Auditing https://www.issai.org/pronouncements/issai-100-fundamental-principles-of-public-sector-auditing/. Retrieved May 2021

[16] ISSAI.Org. 2019. INTOSAI-P-1-The-Lima-Declaration https://www.issai.org/professional-pronouncements/?n=1-9. Retrieved November 2021

[17] Aidi Ahmi et al. 2014. IT adoption by internal auditors in public sector: A conceptual study, International Conference on Accounting Studies 2014, ICAS 2014, 18-19 August 2014, Kuala Lumpur, Malaysia

According to a study by the World Bank Group, SAIs have a shared recognition that they need to respond to the challenge posed by governments increasing their use of sophisticated IT to manage and deliver their policies and programs.[10]

To mitigate the risk introduced by the automation of government systems, SAIs need to adopt technology by automating their business processes and audit processes. SAIs also want to capitalize on the opportunities created by the use of technology for better, more effective audits using IT audit tools and procedures.[10]

AFROSAI-E members conduct an annual self-assessment using the AFROSAI-E Institutional Capacity Building Framework (ICBF). Their answers to a few questions in the ICBF give a perspective of the level of SAI automation[18] (see section 1.2).

Regardless of whether a SAI has automated its processes or not, technology is evolving and will eventually necessitate changes to the currently used systems. It is against this backdrop that this study is conducted to guide SAIs within the region on factors to consider while adopting/changing technologies and to understand the outcomes associated with the adopted technology.

2.4 Factors influencing technology adoption in SAIs

There are prior studies on CAATTS acceptance that have concentrated on individual auditor factors.[19] [20] These studies were mostly based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model.[21] Other studies that have proposed various frameworks such as technology acceptance are also considered. This framework has formed the bases of various studies to identify factors that influence the acceptance of technology including CAATTS.[19] [20] However, these studies consider user acceptance as the dependent variable and are limited to individual factors as independent variables.

[18] AFROSAI-E. 2021. 2020 State of the Region ICBF Self Assessment Report. Pretoria: AFROSAI-E

[19] Nurmazilah Mahzan and Andy Lymer. 2014. Examining the adoption of computer-assisted audit tools and techniques – Cases of generalized audit software use by internal auditors, *Managerial Auditing Journal,* Vol. 29 No. 4, 2014, pp. 327-349

[20] Shihab, M.R. et al. 2017. Determinants of CAATT acceptance: Insights from public accounting firms in Indonesia, *4th Information Systems International Conference 2017*, ISICO 2017, 6-8 November 2017, Bali, Indonesia

[21] Venkatesh, V., Morris, M.G., Davis, G.B. & Davis, F.D. 2003. User Acceptance of Information Technology: Toward a Unified View, *MIS Quarterly*, Vol. 27 (3), pp. 425-478

There are other studies that consider technology adoption from a wider perspective (technological, organisational and environmental).[22] [23] [24] [25] Most of these studies are on the private sector and are based on various theories, the most popular being the Technology-Organisation-Environment framework, Diffusion of Innovation Theory and Institution Theory, or a combination of the three.[26] [27] [28]

Audit of the public sector is different from that of the private sector because of the bureaucracy, regulations, added process steps and generally the unique environmental aspect of public audit. This study therefore investigates factors influencing adoption of technology from the wider Technology-Organisation-Environment (TOE) framework. The TOE framework recommends three elements that have an impact on a firm's adoption of technology namely **technological**, **organisational** and **environmental** context.[26]

2.4.1 Technological context

The TOE framework explains technological aspects such as the advancement of enterprise resource planning (ERP) or accounting software that are commonly used by companies and how they influence adoption of technology.[23] In order to adopt information technology (IT), SAIs need to consider characteristics of technology implemented by the clients being audited, available technologies within the SAI and probable technologies to be adopted. Thus, technological advancement influences the way auditors conduct an audit.[23]

The TOE framework does not explicitly define technological features. Thus, we reviewed as control variables key technological characteristics of the Diffusion of Innovation (DOI) theory[27], namely relative advantage, compatibility, complexity, observability and trialability, plus other variables supported by literature.

[22] Siew, E. et al. 2019. Organizational and environmental influences in the adoption of computer assisted audit tools and techniques (CAATTs) by audit firms in Malaysia, *International Journal of Accounting Information Systems*

[23] Yapa, W.S. et al. 2019. Adopting generalized audit software: an Indonesian perspective, *Managerial Auditing Journal*, Vol. 31 No. 8/9, 2016, pp. 821-847

[24] Rosli, K. et al. 2012. Factors Influencing Audit Technology Acceptance by Audit Firms: A New I-TOE Adoption Framework, *Journal of Accounting and Auditing: Research & Practice:* Research & Practice 4

[25] Rosli, K. et al. 2013. Adoption of Audit Technology in Audit Firms, *24th Australasian Conference on Information Systems*, 4-6 Dec 2013, Melbourne

[26] Tornatzky, L.G. & Fleischer, M., Chakrabarti, A.K. 1990. The Processes of Technological Innovation. Lexington, MA, *Lexington Books*.

[27] Rogers, E.M. 2003. Diffusion of innovations, (5th ed.). New York: Free Press

[28] DiMaggio, P.J., and Powell, W.W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields, *American Sociological Review* (48:2), pp. 147-160.

2.4.1.1 Technological compatibility

Technological compatibility refers to the degree to which the use of audit technology is consistent with audit needs and matches the audit tasks that need to be performed.[25]

SAIs are mandated to audit many clients that have implemented diverse technologies. A technology may be perceived as being useful and advanced, but if it does not fit with audit task requirements, it may not be adopted.[24] This study thus posits that success in adoption of technology by SAIs will be positively influenced by various factors such as compatibility of technology with SAI procedures, fit for purpose and compatibility with client systems, processes and procedures.

2.4.1.2 Technological complexity

The concept of complexity as adapted from DOI theory is defined as the degree of difficulty to understand and use the audit technology.[25] Organisations that perceive an information system being adopted to be too complicated will likely reject the system from being adopted.[27] We therefore hypothesize that the complexity of technology being audited will negatively influence adoption of the technology by SAIs.

2.4.1.3 Technological cost benefit

Investment of SAIs like any other government entities is based on budget allocated to the programme. Relative advantage means a technology is "perceived as being better than the idea it supersedes".[27] In this study, we adapt the definition of technological cost benefit to mean "the perceived benefits that an audit firm would obtain from audit technology outweigh the cost of its adoption".[25] We therefore hypothesize that cost and benefit considerations influence audit technology adoption.

2.4.2 Organisational context

Organisational context is comprised of the organisation's characteristics and resources and includes organisational measures such as decision-making structure, communication process, organisation size and organisation slack.[26] It includes factors internal to an organisation that influence adoption of technology. It could also reflect the organisation's human resource and IS capabilities, organisational IT infrastructure, organisational working culture and readiness towards adopting IT innovation.[25]

Organisational characteristics that are widely cited in literature and considered applicable to this study include top management commitment, employees' IT competency and organisational readiness as discussed in preceding sections.

2.4.2.1 Top management commitment

"Top management support can be defined as the degree to which top management understands the importance of the IS function and is personally involved in IS activities".[29]

With top management support, the communication and coordination necessary for pre-adoption planning and technology adoption by its employees will be expedited. In a study of adoption of cloud computing, it was concluded that top management's role is crucial, especially in developing countries, as they provide the necessary support to facilitate cloud computing adoption by approving the adoption process's financial and human resources.[30] Thus, if SAI management supports the use of the technology being adopted, the employees of the SAI are more likely to embrace and use the technology. This study thus posits that top management commitment will positively influence technology adoption.

2.4.2.2 SAI employees' IT competency

SAI employees' IT competency is the level of IT competency and capability possessed by the SAI's employees. Knowledge and competency of the workforce are key considerations for an organisation to successfully adopt a technology.[26] Prior studies have shown that IT competency of employees of an organisation does influence the adoption of information systems.[22] [25] This study thus posits that SAI employees' IT competency positively influences technology adoption.

2.4.2.3 Organisational readiness

Organisational readiness as used in this study is the level of SAIs' available financial and technological resources to adopt audit technology.[25] A SAI with enough financial resources can implement and support the necessary IT infrastructure and other requirements needed to support technology adoption. Thus, we hypothesize that successful adoption of technology will be positively influenced by SAI readiness.

2.4.3 Environmental context

Environmental context is the external environment in which an organisation conducts its business and includes its industry, competitors, and dealings with the government.[26]

Environmental characteristics that are widely cited in literature and we consider applicable to this study include government regulations, complexity of clients' AIS, professional bodies' support, and vendor services, as discussed below.

29 Jitpaiboon, Thawatchai and Kalaian, Sema A. 2005. Analyzing the Effect of Top Management Support on Information System (IS) Performance Across Organizations and Industries Using Hierarchical, *Journal of International Technology and Information Management*: Vol. 14: Iss. 1, Article 11. Available at: https://scholarworks.lib.csusb.edu/jitim/vol14/iss1/11

30 Ali Al Hadwer et al. 2021. A Systematic Review of Organizational Factors Impacting Cloud-based Technology Adoption Using Technology-Organization-Environment Framework, *Internet of Things*

2.4.3.1 Government regulations

Of late, there have been drastic changes in technology. Governments respond to new technologies by formulating appropriate policies, laws and regulations. These laws and regulations can have either positive or negative effects on the adoption of technologies in the country.[31]

As SAIs are public sector entities, they are required to adhere to these government laws and regulations. Since the ultimate goal of most of these laws and policies is to facilitate the adoption of new technologies, we posit that government regulations generally positively affect the adoption of technology.

2.4.3.2 Complexity of clients' IS

Complexity of clients' IS is defined as the level of complexity, difficulty and volume of transactions processed by clients' IS. SAIs are mandated to audit public sector entities. Where these entities are computerized, the audit extends to include assessment of relevant IT controls. The level of complexity of these systems varies from one client to another. Clients with complex systems may persuade SAIs to adopt technology.[22] [25] We therefore posit that the complexity of clients' IS positively influences SAIs to adopt technology.

2.4.3.3 Professional bodies' support/ Affiliation to professional bodies

Professional bodies' support refers to the degree to which standards, guidance and support by these bodies encourage SAIs to adopt technologies.

Most SAIs are affiliated to Supreme Audit Institution bodies such as INTOSAI, AFROSAI, AFROSAI-E and other professional bodies such as institutes of Certified Public Accountants.[22]

INTOSAI for instance calls on SAIs to be responsive to changing environments and emerging risks.[1] Governments' need of increased use of sophisticated IT to manage and deliver their policies and programs poses challenges to SAIs.[32] Thus, we posit that affiliation to professional bodies positively influences adoption of technology.

2.5 Effect of technology adoption on audits

[31] Organisation for Economic Co-operation and Development (OECD), Regulatory reform and innovation
[32] The World Bank. 2021. Supreme Audit Institutions' Use of Information Technology Globally for More Efficient and Effective Audits

The continuous evolution of technologies has led us to the age of automation which, among other things, greatly benefits audit and all its processes. While an auditor's expertise and professional judgement are yet to be matched,[33] [34] some of the advantages of audit automations are:

- ✓ Better use of resources.
- ✓ Increased efficiency and reduced costs.
- ✓ Auditors should plan their work to ensure that the audit is conducted in an effective and efficient manner.[15] Automation in audit assists in bringing these efficiencies.
- ✓ Higher quality output and reliability.
- ✓ More business value.
- ✓ Management of electronic files: security and backup devices.
- ✓ Provision of resources for the entire team of auditors, to allow them to work in networks (both on- and offline).
- ✓ Release of more experienced employees to dedicate themselves to more technical and higher risk areas.
- ✓ Adding value to the audit work.
- ✓ Faster information flow.
- ✓ Automation in audit can assist in implementing continuous audit.
- ✓ Automation reduces the potential disruption (such as that caused by the COVID-19 pandemic) and ensures continuity.

Audit automations will most likely improve quality of audit reporting, increase efficiency during an audit assignment and eliminate errors in the production of audit reports.[35] In their conclusion, the World Bank Group (2021) found that IT-based methods and procedures create the opportunity for SAIs to improve the quality, efficiency and effectiveness of their audits.

Audit quality encompasses the key elements that create an environment which maximizes the likelihood that quality audits are performed on a consistent basis.[36] IFAC further points out that the responsibility for audit quality rests with the auditor and is likely to have been achieved by an engagement team that:

- ✓ Exhibited appropriate values, ethics and attitudes.

[33] Deloitte Development LLC Adopting Automation in Internal Audit. 2018. https://www2.deloitte.com/us/en/pages/risk/articles/internal-audit-robotic-process-automation-adoption.html. Retrieved July 2021

[34] Dutra, E.C. Auditoria de Sistemas de Informação: Introdução, Controles Organizacionais e Operacionais. Jus.com.br. 2020. https://jus.com.br/artigos/56084/auditoria-de-sistemas-de-informacao-introducao-controles-organizacionais-e-operacionais. Retrieved July 2021

[35] Danielle Lombardi, Villanova University, Pennsylvania, United States. *USA Journal of Information Systems and Technology Management* Vol. 11, No. 1, Jan/Apr. 2014, pp. 21-32

[36] International Federation of Accountants (IFAC). 2014. Framework for Audit Quality: Key Elements That Create an Environment for Audit Quality

- ✓ Was sufficiently knowledgeable, skilled, and experienced and had sufficient time allocated to perform the audit work.
- ✓ Applied a rigorous audit process and quality control procedures that complied with laws, regulations and applicable standards.
- ✓ Provided useful and timely reports.
- ✓ Interacted appropriately with relevant stakeholders.

This study therefore posits that technology adoption positively influences the quality of audits undertaken by SAIs.

2.6 The moderating effect of voluntariness on environmental factors

Technology adoption is termed as deliberate adoption where the adoption is strategized from a conscious, thoughtful, and organised action on the part of the organisation and its leadership. Such a strategic approach of adoption methodology is typically created from rigorous analysis of available data and metrics including customer/clientele needs, competitors' strength and weakness, market growth, segment size and technological trajectories. Deliberate adoption only works effectively when everybody understands what the organisation is trying to accomplish.[37] Deliberate adoption of new technology is a better fit for organisations once the entity has attained a certain level of maturity and stability in terms of IT usage, at which point the institution can shift from survival towards growth. Typically, the difference between success and failure when implementing a deliberate adoption is how well individual employees/departments in the organisation embrace the new technology in the execution of their respective tasks. Therefore, the deliberate adoption strategy must make sense to everyone within the organisation from individual employees to top-level managers.

For many firms, pressure to keep up with the competition, providing a means to enhance survival and/or growth, managing change, promoting services to customers and staying competitive and/or enhancing innovation abilities have forced them to adopt IT.[38] Prior literature suggests that as small businesses are susceptible to customer pressure, these firms adopted IT as a result of demand from customers to develop the efficiency of their inter-organisational dealings.[39] Hence, it has become an indispensable strategy for firms or institutions to have these technologies, while others suggested that the main driving forces to move toward IT tools adoption in small and medium enterprises (SMEs) are internal factors, including

[37] Clayton Cristensen. 1997. The Innovator's Dilemma

[38] Premkumar, G., Roberts, M. 1999. Adoption of new information technologies in rural small businesses. *Omega* 1999, 27, 467-484

[39] Levy, M., Powell, P., Yetton, P. 2002. The dynamics of SME information systems. *Small Bus. Econ.* 2002, 19, 341-354

industrial changes and trends, maintaining the current market, finding new markets, opportunities for growth and the necessity to keep up with competition.[40]

On the other hand, and according to prior IS literature, drivers for IT adoption in many institutions and organisations are also attributable to the institution's or firm's wish and need to stay competitive and innovative as necessities for its survival.[41]

It has been demonstrated that competitive pressure will affect the adoption of new technologies when institutions and businesses perceive that these technologies will possibly support their competitive position; therefore, institutions and businesses adopt information technologies to gain competitive advantage.[42]

Some reports suggest that even innovative individuals resist the innovation in the context of forced adoption.[43] Product trial and repetitive usage significantly reduce innovation resistance and create favourable post-adoption evaluation (attitude and satisfaction judgements). Individuals who perceive themselves to have technical competence offer less resistance to the innovation. Further, organisational members deal with forced adoption using coping mechanisms such as complaining and seeking peer help.

We propose voluntariness (Deliberate/Proactive Adoption of Technology or Forced Adoption of Technology) as a moderating variable that influences the relationship between government regulations and professional bodies' support and technology adoption by SAIs. This is consistent with prior studies[21] which found voluntariness to moderate the relationship between social influence and behavioural intention to use technology. We therefore hypothesize that the influence of government regulations and professional bodies' support on technology adoption will be moderated by voluntariness.

[40] Southern, A., Tilley, F. 2000. Small firms and information and communication technologies (ICTs): Toward a typology of ICTs usage. *New Technol. Work Employ.* 2000, 15, 138-154.

[41] Ghodakhloo et al. 2010. The interactive model of user information technology acceptance and satisfaction in small and medium size employees, *Eur .J. Econ. Finan. Adm Sci.* 2010. 19, 7-27

[42] Ghobakhloo, M., Benitez-Amado, J., Arias-Aranda, D. 2011. Reasons for Information Technology Adoption and Sophistication within Manufacturing SMEs. In the POMS 22nd Annual Conference: Operations Management: The Enabling Link, Reno, NV, USA, 29 April–2 May 2011.

[43] Ram and Hyung-Shik Jung. 2003. Forced Adoption of Innovations in organization; Consequences and Implications. September 2003 *Journal of Product innovation management* 8 (2) 117-126 DOI: 10,1111/1546, 5885, 820117

3 THEME STUDY METHODOLOGY

3.1 Introduction

This section provides a description of the research procedures adopted in this study. It explains the research paradigm and research design with the following sub-themes: Data collection methods, Sampling methods, Population and sample size determination and Data analysis. It further describes the research instruments used in data collection and presents how the research team collected and analysed the data to meet the objectives of the study.

3.2 Research paradigm

A paradigm is defined by various researchers based on their own understanding, as there is no one correct specific definition. Some scholars have defined it as:

- ✓ The philosophical way of thinking,[44] or
- ✓ The philosophical framework that provides guidance on how, what and the interpretation of the study findings,[45] or
- ✓ The most important set of concepts that researchers need to align their methodological approach to answer the research question.[46]

The research chose the pragmatic research paradigm because it is known as the philosophical framework that is practical, realistic and supports a mixed-methods approach of quantitative and qualitative as opposed to the interpretivism and positivism paradigms which both support merely qualitative or quantitative methods. Furthermore, the pragmatic research paradigm is well suited to the business problem that is pursued in this study.[47] [45]

3.3 Research design

To address the research objectives more effectively, this research undertook a cross-sectional case study survey design. Furthermore, explanatory research was appropriate for use in this study as it focused on discovering causality between variables of concern to the study and is an expansion of both descriptive

[44] Kuhn, T. S. 1962. The structure of scientific revolutions. (1st Edn). Chicago, IL: University of Chicago Press.

[45] Kivunja, C. & Kuyini, A.B. 2017. Understanding and applying research paradigms in educational contexts. *International Journal of higher education*, *6*(5), 26-41.

[46] Ragab, M.A., & Arisha, A. 2018. Research methodology in business: A starter's guide. *Management and Organizational Studies*, *5*(1), 1-14.

[47] Mertens, D.M. 2012. What comes first? The paradigm or the approach?

and exploratory designs. Thus, explanatory research helped to identify relationships between technological, environmental and organisational factors and technology adoption.

1. A survey was used in line with Anderson.[48] A survey method was used because of the nature of the research, which can be classified under the applied social sciences, and it involved the use of a questionnaire as a data collection technique. A survey is also easier to administer, analyse and is not very exposed to biases.

2. Case study − A case study method was used because the research itself is an in-depth study of a regional grouping of SAIs in Africa called "AFROSAI-E". Accordingly, in evaluation, case studies can be used to capture the complexity of a case, including temporal changes, as well as exploring the contextual conditions of a case.[49] It can thus be argued that a case study provides more realistic responses than a purely statistical survey.

3.3.1 Data collection methods

Survey questionnaire was used to gather quantitative data from experienced SAI management personnel. The details of data gathering mentioned above follow in the subsection below.

Quantitative

Quantitative research focuses on collecting data through survey questionnaires, structured observations and experiments, which is quantifiable and numerical.[46] The researchers collected data by using the questionnaire (Appendix 1) from 15 October to 7 November 2021. To ensure that the data collected was of high quality, several quality assurance mechanisms were implemented. The researchers announced the research to the population and conducted several information sessions to explain the study objectives and clarify any issues regarding the study instrument as well as any pertinent issues of the study. After data collection was completed, the researchers cleansed the data of errors prior to analysis. This was done to guarantee consistency and completeness of the data.

The researchers gathered quantitative data from sampled SAI employees in the AFROSAI-E region. The researchers followed all ethical aspects which involved soliciting for participation through writing to the Heads of SAIs to get permission to gather data from their staff members. The sample consisted of SAI employees who were in managerial positions as these were deemed knowledgeable in the space under investigation.

[48] Anderson, R. Intuitive inquiry: An epistemology of the heart for scientific inquiry. *The Humanistic Psychology*, 32(4), pp. 307-241.
[49] Ibid.

Both primary and secondary data were used in this study. Secondary data was collected through the review of relevant published research documents. On the other hand, primary data was gathered from respondents using surveys.

3.3.2 Sampling methods

A probability sampling method was used for the quantitative part of the research; specifically, stratified sampling was used. This separates population into overlapping distinct groups that are called strata. The strata in this case were different regional groupings of SAIs in Africa. Stratified random sampling was preferred in this case as it captures key population characteristics of the sample. This technique also produces characteristics in the sample that are proportional to the overall population. Furthermore, stratified random sampling minimizes sample selection bias. However, the researcher was aware of the drawbacks of this sampling method. Stratified random sampling is unusable when a researcher cannot assertively classify every member of the population.

3.3.3 Population and sample size determination

The population of the study is the entire group from which the researcher or study would like to draw conclusions. Population can be people and organisations. In the context of this study the population was employees in Supreme Audit Institutions (SAIs) from the AFROSAI-E region. The size of the sample is an important parameter of the sample design because it affects the precision, cost and duration of the survey more than any other factor. Its determination was based on some statistical determinants such as margin of error, design effect and total population. The Creative Research Systems,[50] a sample size calculator which makes use of the above three stated statistical determinants, was employed in the determination of a statistically appropriate sample size.

Using the sample size calculator and allowing for an error margin of 10% and 95% confidence level and a population of 100, a sample of 46 respondents was obtained as the minimum size that can credibly mimic population characteristics of the study. Additionally, the research team utilised multiple data sources to get further assurance and acceptable and credible responses for the study.

3.3.4 Data analysis

Research data was analysed using descriptive statistics and to ascertain relationships between variables, correlation analysis and regression were used. The researchers used Statistical Package for Social Sciences (SPSS) as the main software tool.

[50] https://www.surveysystem.com/sscalc.htm#one <Online accessed 03 August 2020>

Data was first examined for missing or misplaced values by checking minimum and maximum values as well as measures of central tendencies and measures of spread such as variances and standard deviations. Descriptive data was presented using percentages, means, standard deviations, frequencies, figures, graphs and tables for ease of understanding. However, relationship between variables was analysed with reference to Pearson correlation and multiple regression analysis. In the case of multiple regression analysis, Environmental factors, Organisational factors and Technological factors were independent variables while Technology adoption or automation was the dependent variable. The influence of each independent variable was measured based on the significance of the associated coefficient using p value. A p value that is less than 0.05 ($p < 0.05$) means that the associated independent variable has a significant influence on the dependent variable. The opposite also holds true.

3.3.5 Research ethics

Ethical considerations, being an important moral principle, were followed in conducting this research. The research ensured that respondents were fully aware about the research before they took part. The SAIs in the population were informed about the research. Consent was sought from both SAIs and the respondents from the SAIs who took part in the survey.

Confidentiality and anonymity were also upheld, and respondents were fully informed on this aspect. Research members taking part in the research were informed of the need to maintain confidentiality.

4 THEME STUDY RESULTS

4.1 General information

For the research, questionnaires were distributed to various SAI members and a total of 46 respondents took part in the study. Section A of the questionnaire covered demographic information of the respondents (shown in Table 2). It can be observed that more males participated in the study and contributed 73% to the total. Females contributed the remaining 27%. Most of the respondents were over 30 years old. Only about 6% of the respondents were less than 30 years of age. About 57% of respondents were postgraduates while none were holders of diplomas or PhD degrees. Only 2% of respondents declared that they were in possession of basic certificates. The high literacy of respondents is of great value to the research, as it enables them to provide insightful and priceless opinions on the automation and technology selection at SAIs.

A total of 31% of respondents confirmed that they had amassed between 1-5 years' experience working in the SAI environment as shown in Table 2, while 28% of respondents shared that they had been working for SAIs for between 11 and 20 years. In addition, 24% of respondents confirmed that they had been working for SAIs for between 6 and 10 years. However, 13% of respondents confirmed that they had amassed more than 20 years working for SAIs. Only 2% of respondents confirmed that they were still in their first year working for a SAI. The above information shows that most respondents have been working for SAIs for a while now. The experience shown by respondents is valuable for this study as it enables them to provide accurate insights on their experiences in the adoption of technologies at SAIs.

Many respondents were in the technical IT discipline (32%) while 30% were in the technical audit function. However, 22% of respondents were in management function and 11% were directors. This distribution of respondents covered pertinent and wide positions within the organisation providing a reasonable sense of balance of opinions across functional positions on the automation and technology selection at SAIs.

Table 2: Distribution of respondents according to demographic information

	Characteristic	Count	Percentage (%)
Gender	Male	34	73
	Female	12	27
Age Group (years)	Below 30	3	6
	30-35	13	28
	36-45	19	41
	46-55	9	20
	56 and above	2	4

Qualifications	Certificate	1	2
	Diploma	0	0
	Graduate	19	41
	Postgraduate	26	57
	PhD	0	0
Experience	Less than 1 year	1	2
	1-5	14	31
	6-10	11	24
	11-20	13	28
	More than 20	6	13
Function in Organisation	Director	5	11
	Management	10	22
	Operations/Logistics	1	2
	Technical IT	16	34
	Technical audit	14	30
	Administration	0	0

Employee establishment plays an especially important role as far as acquiring technology is concerned. It is based on this notion that the researchers found it prudent to establish how many employees each SAI has. From the results, it can be observed that (Figure 4-1) 63% of SAIs employ between 101-500 people. However, 16% of the SAIs employ above 500 people. No SAI establishment employs less than 50 people.

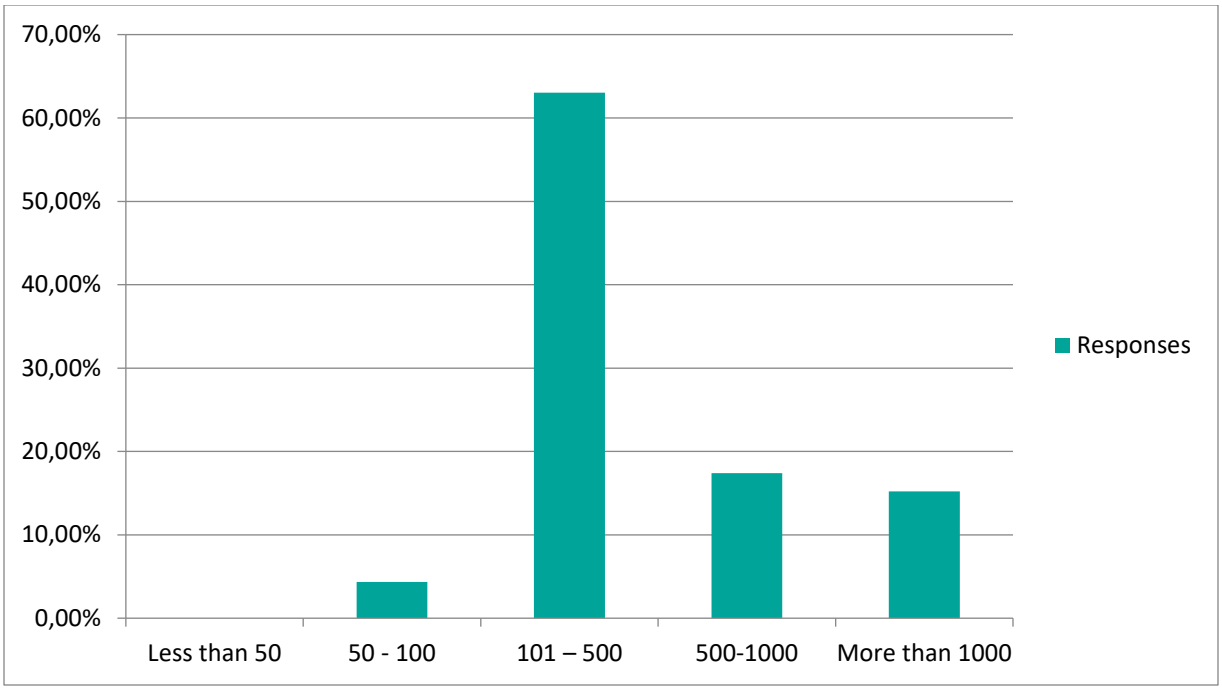


Figure 4-1: Number of people employed in each SAI establishment

The ICT management department is often referred to as IT/ICT support. The section is mandated to ensure the continuous availability of ICT resources. According to the commonwealth[51] the ICT management department plays an active role in imparting the skills and knowledge to users as well as in supporting network and networked peripherals and software applications.

It is based on this reason that the researchers sought to find out if there would be support should the SAI adopt and automate technology. According to the study, a significant number of SAIs at 89% have a dedicated IS management department compared to approximately 11% that do not, or use other means for IS support (Figure 4-2). The indication is that should the SAIs decide to introduce technology, the institution will not struggle to get support since the IS management will be available to provide support services when the need arises.

[51] JOB AND TASK DESCRIPTION: Strategy, Portfolio, Partnerships and Digital Division (ICT Section), General information

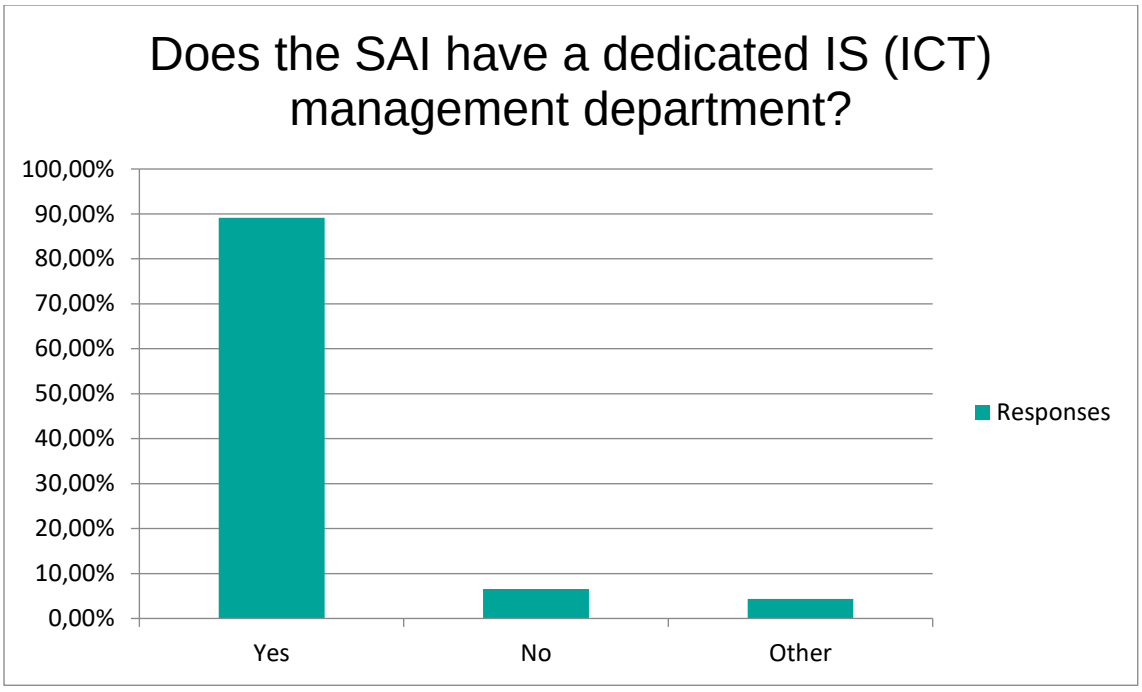


Figure 4-2: Responses on the availability of a dedicated IS management department

4.2 Descriptive statistics on technological factors influencing technologies to adopt for audits

4.2.1 Technological compatibility

In the study, respondents were required to indicate if there were any capability issues between the adopted technology and the existing procedures based on the selected criteria. Figure 4-3 shows that 41% and 22% agreed and strongly agreed that there was compatibility between the new and the existing technologies in their SAIS. This was demonstrated by some respondents who indicated that the working papers were converted to electronic format without any problems.

To the contrary, 7% disagreed while only 28% expressed neutral opinions. However, the majority of them indicated that the adopted technologies are indeed compatible. They cited that there are already technologies in their SAIs which are compatible with technological advancement.

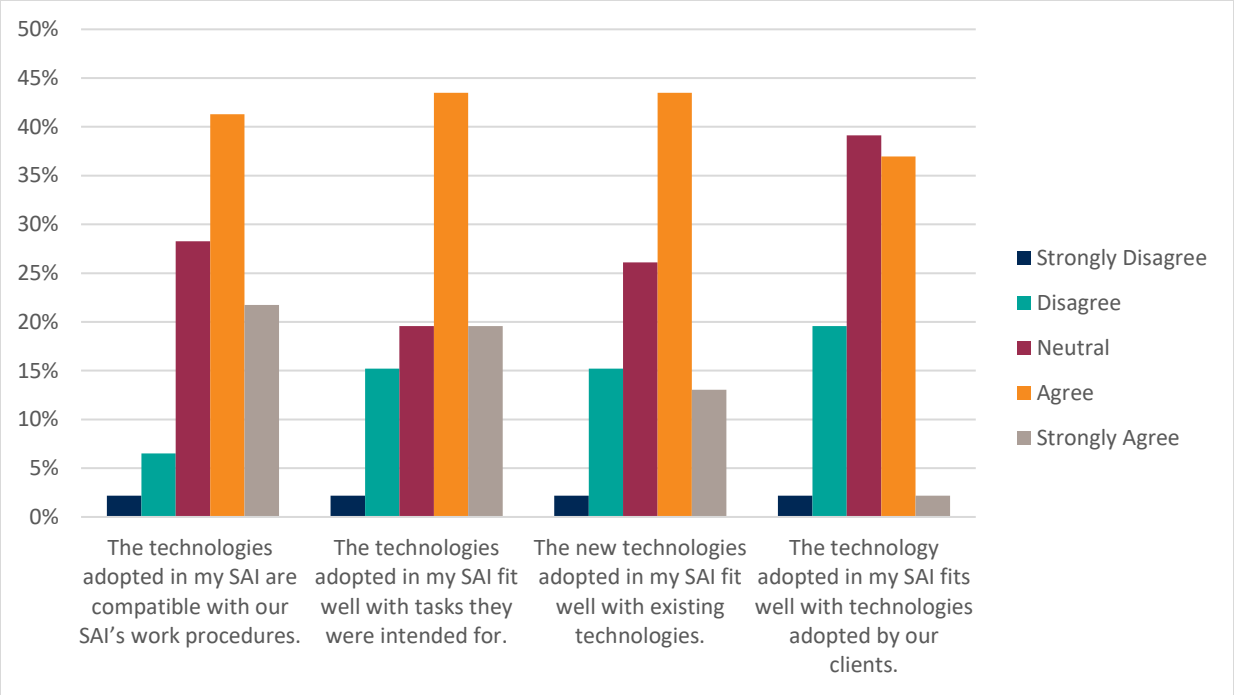


Figure 4-3: Responses on technological compatibility

4.2.2 Technological complexity

Businesses acquiring product of high technological complexity are most likely to face the risk of failing and exiting the industry as compared to those running on less complex technologies.[52] To ascertain if technological complexity has an impact on the adoption of technologies by SAIs, respondents were requested to answer four questions that gave an overall understanding of the subject matter.

Approximately 15% and 41% of the respondents strongly disagreed and disagreed respectively that using the system takes too much time from normal duties while about 26% and 4% of them agreed that systems take much time. However, only 13% of respondents expressed neutral opinions as shown in Figure 4-4.

Respondents were asked if working with the system was complicated and difficult to understand. Approximately 11% and 61% indicated that they strongly disagreed and disagreed respectively with the statement. None of them strongly agreed while approximately 17% expressed neutral opinions on this statement. However, 11% of the respondents agreed with the statement.

[52] Singh, Kulwant. The Impact of Technological Complexity and Interfirm Cooperation on Business Survival. *The Academy of Management Journal*, vol. 40, no. 2, 1997, pp. 339-67, https://doi.org/10.2307/256886. Accessed 3 May 2022

It was observed that 4% and 41% strongly disagreed and disagreed respectively that using the system involves too much time doing mechanical operations compared to the 22% and 4% who agreed and strongly agreed respectively with this statement. About 28% of respondents were not sure regarding this matter.

On the other hand, nearly 9% and 41% strongly disagreed and disagreed respectively that it takes too long to learn how to use the system to make it worth the effort. About 30% were not sure and 20% agreed while none strongly agreed.

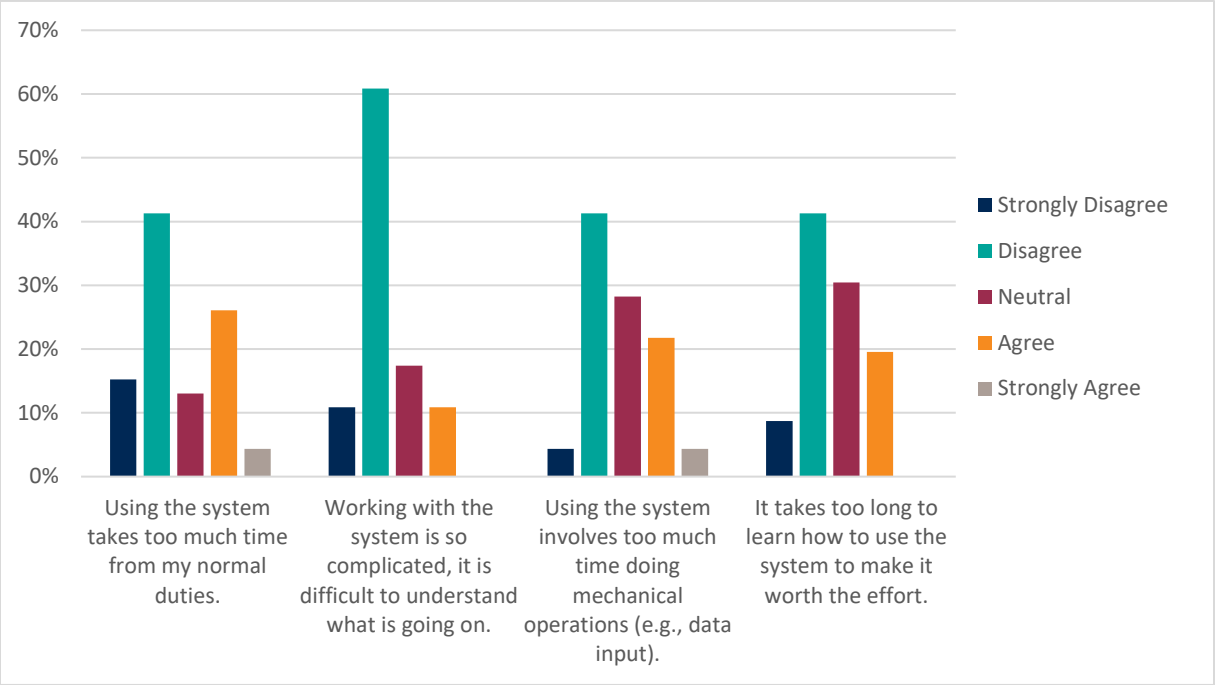


Figure 4-4: Responses on technological complexity

4.2.3 Technological cost benefit

The rate at which IT investments fail advances legitimate concerns about their value and as such, investment in technology needs a serious business case such as assessing the cost and the output from the investment.[53] In the context of this study, cost benefit is about whether the audit entity gains more compared to the expenditure in technology adoption (Figure 4-5).

None of the respondents strongly disagreed that the benefits of using technology outweigh its initial investment cost. A total of 13% of respondents disagreed while 17% expressed neutral opinions on this

[53] Overview: Cost Benefit Analysis (CBA): https://www.vita.virginia.gov/media/vitavirginiagov/it-governance/pdf/CostBenefitAnaylsisOverview.pdf

matter. However, 41% and 28% agreed and strongly agreed respectively that the benefits of using technology outweigh its initial investment cost.

A total of 2% and 7% strongly disagreed and disagreed respectively that the benefits of adopting technology outweigh its ongoing maintenance cost. However, 24% of respondents were not sure while 52% and 15% agreed and strongly agreed with the statement.

On the benefits of integrating new technology with SAIs' existing information systems and if the benefits are greater than the integration cost, none of respondents strongly disagreed and 9% disagreed with this statement. Nonetheless, over 22% of respondents were not sure while 48% and 22% of the respondents agreed and strongly agreed respectively with the above statement.

Just as in previous attributes none of the respondents strongly disagreed that the benefits of using adopted technologies compensate for the cost of training staff to use the technology. A total of 11% of respondents disagreed with the above statement while 28% were not sure. A total of 39% of respondents and 22% respectively agreed and strongly agreed with the above statement as shown.

On the issue of efficiency, none of respondents disagreed. A total of 4% of the respondents were not certain if adopting technology will improve efficiency through reduced paperwork. However, 33% of the respondents agreed while 63% strongly agreed with the above statement.

A total of 2% of the respondents disagreed that adopting technology will provide accurate information for decision making while 4% expressed neutral opinions. Additionally, a total of 37% of respondents agreed while 57% strongly agreed with the above statement.

However, about 2% of the respondents disagreed that adopting technology will increase SAIs' productivity. None of the respondents expressed neutral opinions nor strongly disagreed. A total of 35% and 63% of the respondents respectively agreed and strongly agreed with the above statement as shown.

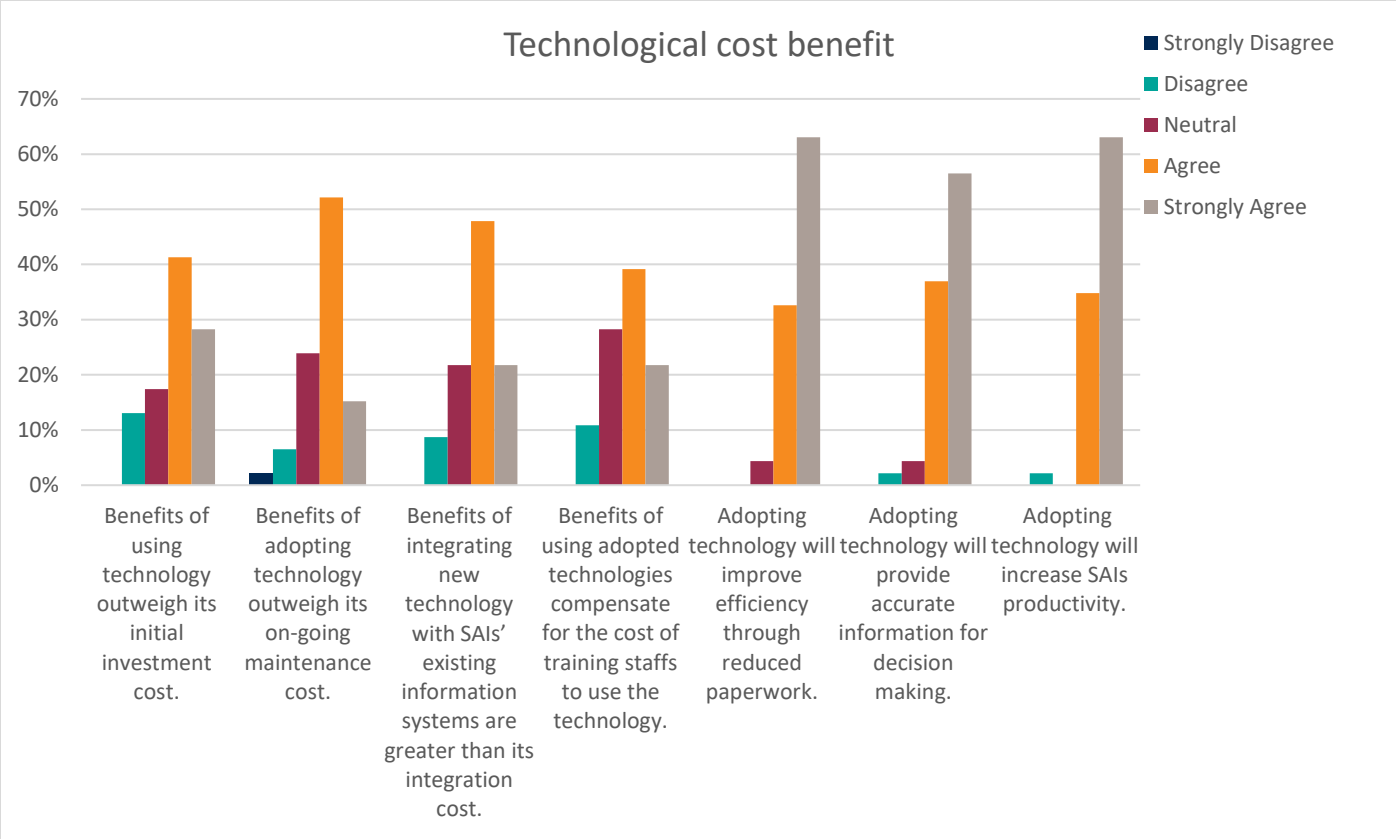


Figure 4-5: Responses on technological cost benefit

4.3 Organisational factors influencing technologies to adopt for audits

4.3.1 Top management commitment

It is a known fact that in every undertaking, top management commitment has an influence on the success or failure of the project. According to research by Ofer Zwikael[54] "executives in the software sector spend much effort in supporting projects in numerous ways". The author continues to state that there is an indication that many managers are not mindful or are ignorant of the effect they have in supporting the success of the projects and support process with low impact on the project's success. Figure 4-6 shows opinions of respondents on top management commitment in SAIs when adopting technology.

When asked if top management closely links technology adopted with the SAI's overall strategy, a total of 2% and 15% of the respondents strongly disagreed and disagreed respectively with the above statement. A total of 22% of the respondents expressed neutral opinions, another 22% strongly agreed while 39% agreed with the statement.

[54] Ofer Zwikael. 2018. Top management involvement in project management

On whether top management is willing to take the risks involved in technology adoption, none of the respondents strongly disagreed but only 13% disagreed with the statement. A total of 7% of the respondents were not sure about this while 70% agreed and 11% of the respondents strongly agreed.

A total of 4% and 9% of the respondents strongly disagreed and disagreed respectively that top management provides adequate financial resources for technology implementation. However, 20% of the respondents were not sure whereas 50% and 17% of the respondents agreed and strongly agreed with the above statement.

A total of 2% and 11% of the respondents strongly disagreed and disagreed that top management provides strong support for technology usage in SAIs' operations. A total of 20% of the respondents expressed neutral opinions. However, 46% and 22% of the respondents respectively agreed and strongly agreed that top management provides strong support for technology use in SAIs' operations.

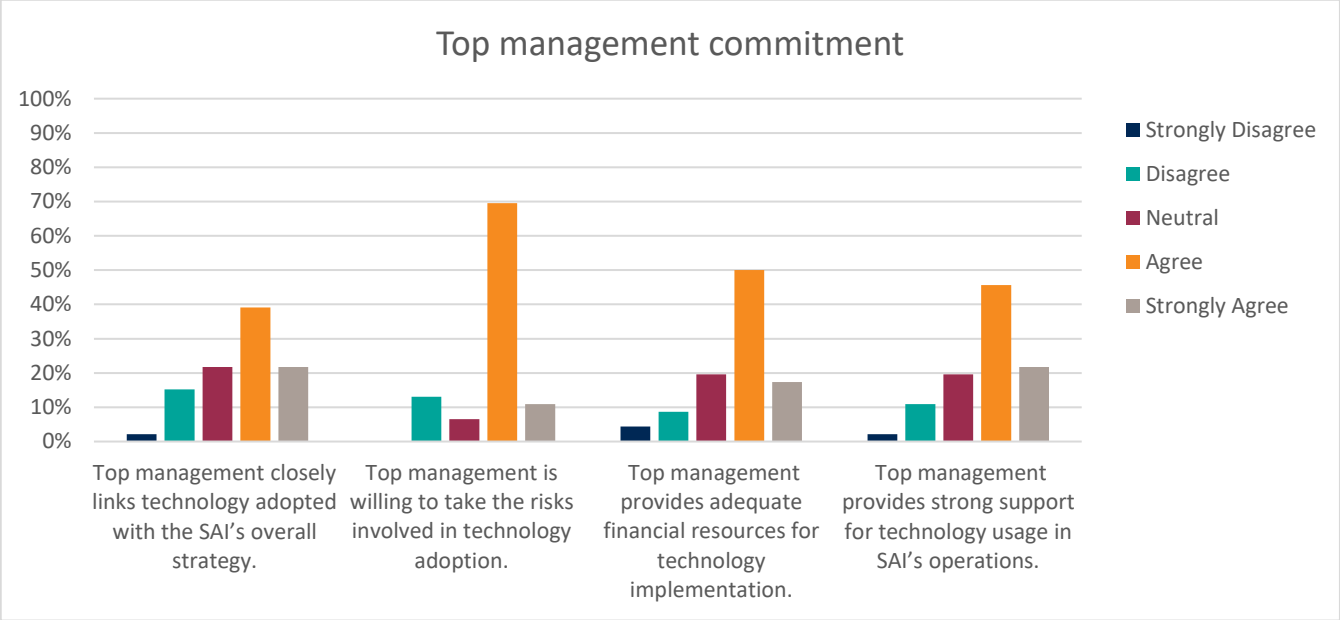


Figure 4-6 Responses on top management commitment

4.3.2 SAI employees' IT competency

Employee competency is vital when acquiring IT systems, otherwise the entity will buy systems and render them useless due to poor competence. Lack of training and IT skills in organisations can result in a limited use of IT and lack of success in reaping benefits from computer hardware and software (IT). Therefore,

training should be done before rollout of the system. The training will add to the IT competency of the staff.

Respondents were required to indicate the level of IT competencies in their SAIs. Figure 4-7 captures the opinions of the respondents. A total of 57% and 15% of the respondents respectively strongly agreed and agreed that their employees are IT literate. However, 28% of the respondents were not sure and none of the respondents strongly disagreed or disagreed with the above statement.

A total of 59% and 22% of the respondents agreed and strongly agreed respectively that their SAI had at least one expert in adopted technologies. A total of 11% of the respondents expressed neutral opinions while 9% disagreed and none strongly disagreed with the statement above.

On whether SAI staff members have skills to operate adopted technologies, none of the respondents strongly disagreed or disagreed with the above statement. A total of 33% of the respondents expressed neutral opinions while 61% and 7% agreed and strongly agreed respectively that the staff have skills to operate the technologies adopted.

With regard to whether employees have experience with adopted technologies, a total of 54% and 4% of the respondents agreed and strongly agreed respectively that experience does exist in their SAIs. A total of 33% of the respondents remained neutral on the matter while 9% disagreed. None of the respondents strongly disagreed with the above statement.

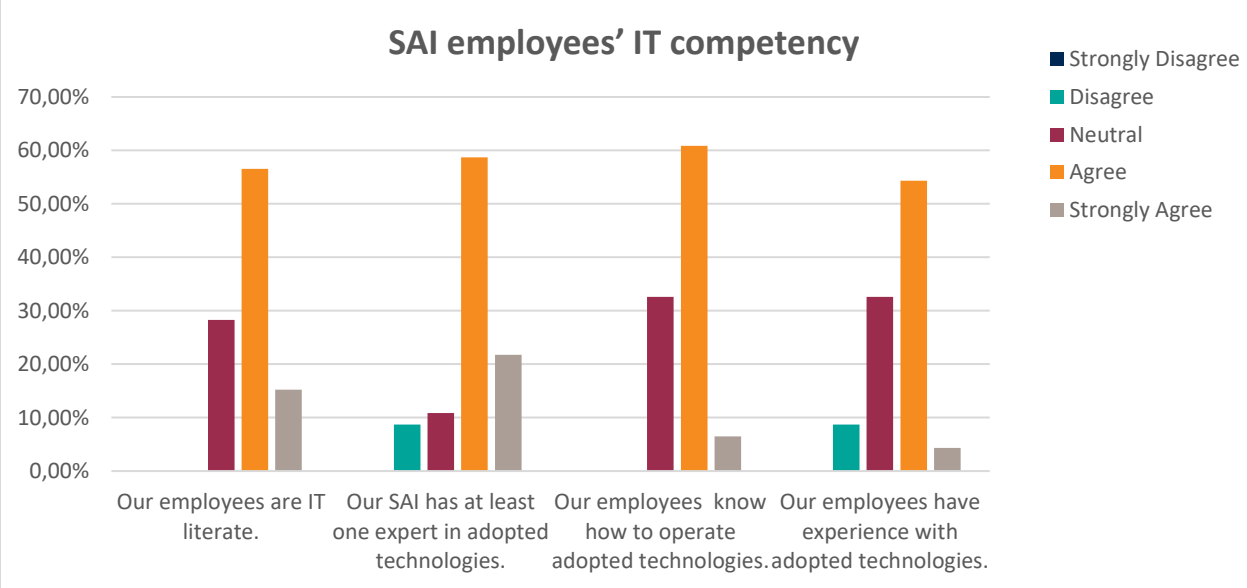


Figure 4-7: Responses on SAI employees' competency

4.3.3 Organisational readiness

Milovanovic and others stated that organisational commitment is dependent on the employees' characteristics, experience, job position characteristics, and structural characteristics of the company and is linked to demonstrative attachment.[55]

To determine if organisational readiness influences technology adoptions, respondents were asked to indicate either by strongly disagreeing, disagreeing, agreeing or strongly agreeing on the given criteria and the results are presented in Figure 4-8.

A total of 4% and 13% of those who took part in the survey strongly disagreed and disagreed respectively that their SAI has financial resources to support usage of adopted technologies. However, 26% of the respondents were not sure while 52% and 4% of the respondents respectively supported the notion that the SAIs are financially resourced to support it.

On the issue of SAIs having IT resources to support usage of adopted technologies, a total of 67% and 7% of the respondents respectively agreed and strongly agreed with the above statement. However, 17% of the respondents were not sure while 7% disagreed and 2% of the respondents strongly disagreed with the above statement.

A total of 2% of the respondents strongly disagreed that their SAI is willing to provide training on adopted technologies. A total of 2% of the respondents disagreed, 22% were not sure, 70% agreed and 4% of the respondents strongly agreed with the above statement.

On the statement about SAIs being ready to provide technical expertise to support usage of adopted technologies, none of the respondents strongly disagreed. However, 9% disagreed with the above statement while 20% expressed neutral opinions. In addition, 65% of the respondents agreed strongly while 7% of the respondents disagreed that the SAI is ready to provide technical support.

A total of 2% and 9% of the respondents respectively strongly disagreed and disagreed that the SAI has the IT facilities needed to implement adopted technologies. A total of 22% of the respondents were not sure while 59% and 9% of the respondents respectively agreed and strongly agreed that the SAI has IT facilities needed to adopt technologies.

[55] Moric Milovanovic, Bojan, Zoran Bubas, and Matea Cvjetkovic. 2022. Employee Readiness for Organizational Change in the SME Internalization Process: The Case of a Medium-Sized Construction Company. *Social Sciences* 11: 131. https://doi.org/10.3390/ socsci11030131

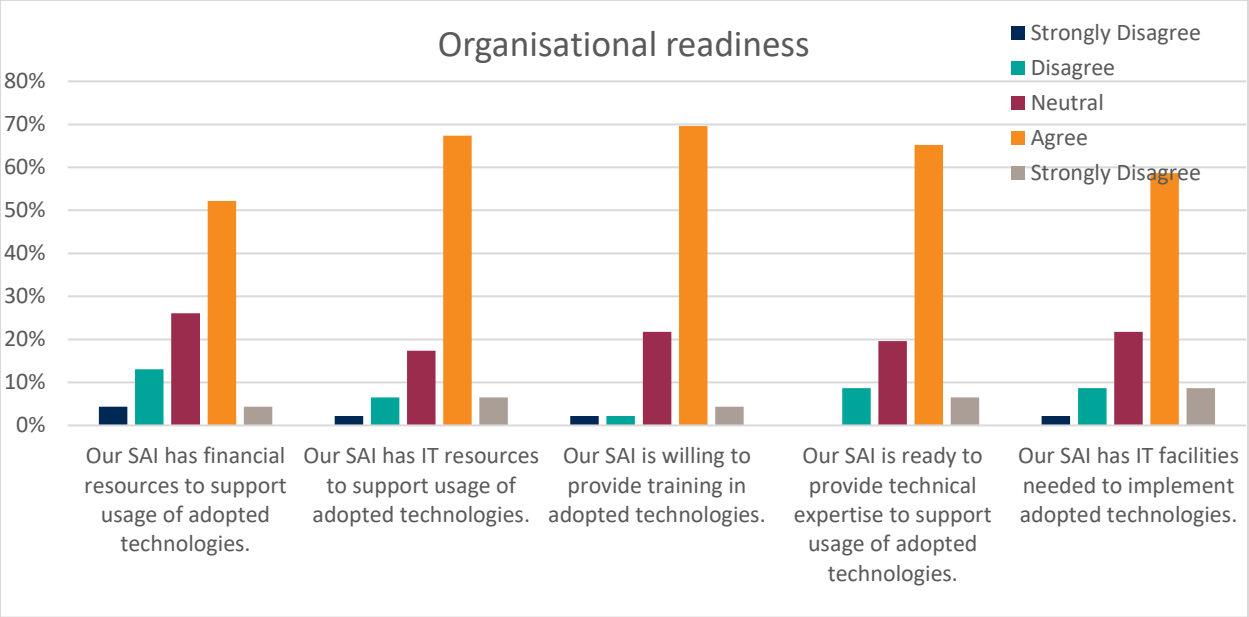


Figure 4-8: Responses on organisational readiness

4.4 Environmental factors influencing technologies to adopt for audits

4.4.1 Government regulations

According to the World Economic Forum[56] "Governments regulate business to deliver better outcomes for the economy, society and the environment, the regulations can motivate ideas and can block their implementation". The literature in this study says laws and regulations can have both positive and negative impacts on the innovation process. To confirm that, respondents were required to indicate the impact of government regulations based on the given criteria and the results are indicated in Figure 4-9.

A total of 2% and 9% of the respondents strongly disagreed and disagreed respectively that there are clear laws and regulations guiding the public sector on procurement and use of IT. A total of 7% of the respondents expressed neutral opinions on this subject while 69% and 13% of the respondents agreed and strongly agreed (respectively) with the above statement.

A total of 2% of those who took part respectively strongly disagreed and disagreed that the government highly recommends the public sector entities (SAI included) to adhere to the laws and regulations on procurement and use of IT. A total of 11% of the respondents were not sure, while 67% and 18% of the respondents agreed and strongly agreed respectively that the government recommends adherence to laws and recommendations.

[56] Agile Regulation for the Fourth Industrial Revolution .2020. A Toolkit for Regulators

A total of 4% and 2% of the respondents strongly disagreed and disagreed respectively that the government recommends staff dealing with procurement and use of IT to be professional in their areas of specialization. A total of 16% of the respondents were not sure while 67% of the respondents agreed and 11% strongly agreed with the above statement.

On whether the government organises and offers specialized professional training for staff dealing with procurement and use of IT, 2% and 11% of the respondents strongly disagreed and disagreed respectively on the above statement while 31% of the respondents expressed neutral opinions. However, 42% and 13% of the respondents agreed and strongly agreed respectively that the government organises training for staff dealing with procurement and use of IT.

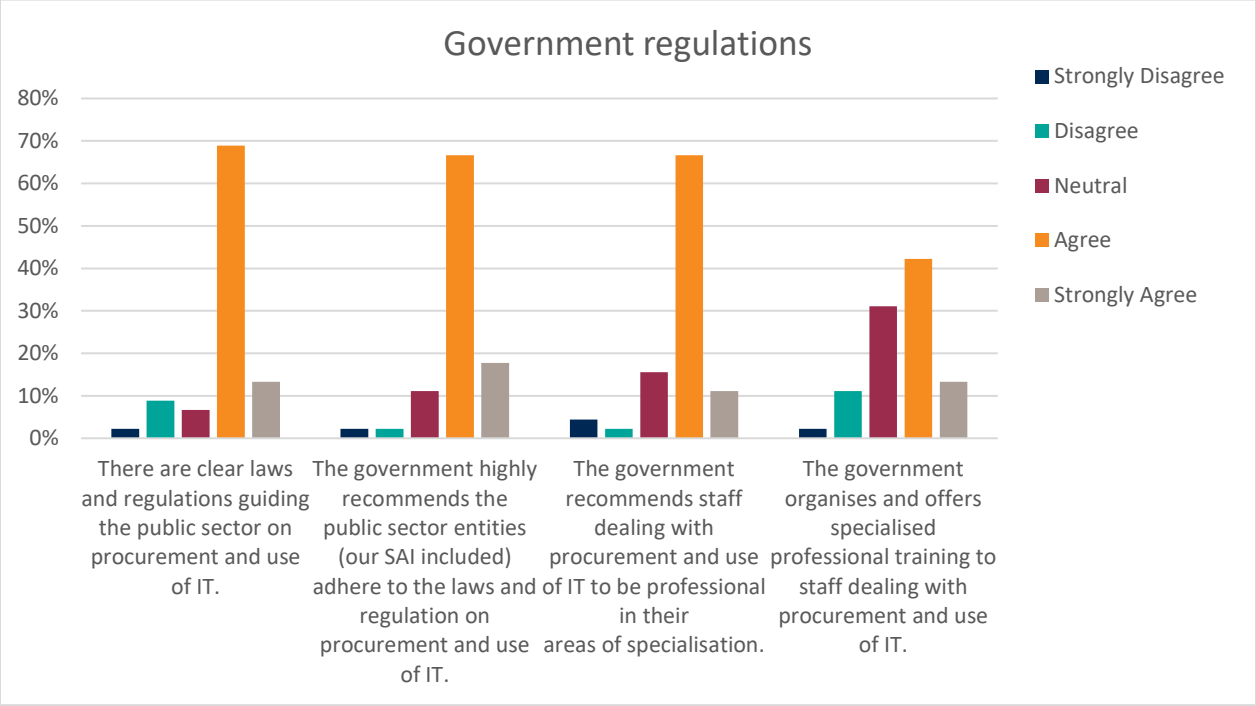


Figure 4-9: Responses on government regulations

4.4.2 Complexity of clients' IS

The complexity of clients' information systems can have an impact on the technology that the SAI has adopted or is willing to adopt. The study wanted to establish the level of complexity of audited entities' information systems. The results are shown in Figure 4-10.

When asked, 2% of respondents strongly disagreed that the majority of clients have large accounting transaction volumes. A total of 7% of respondents neither agreed nor disagreed while 91% of the respondents agreed (58% agreed, 33% strongly agreed) with the above statement.

A total of 24% of the respondents disagreed (2% disagreed, 22% strongly disagreed) that the majority of their clients have complex financial reporting systems while 33% of respondents could not state whether they agree or not. However, a cumulative 42% agreed (33% agreed, 9% strongly agreed) that clients use complex systems.

A total of 4% and 20% of the respondents strongly disagreed and disagreed respectively that most of their clients have highly computerized financial reporting systems. On the other hand, a total of 22% of the respondents were not sure about this while 47% and 7% of the respondents respectively agreed and strongly agreed with the statement above.

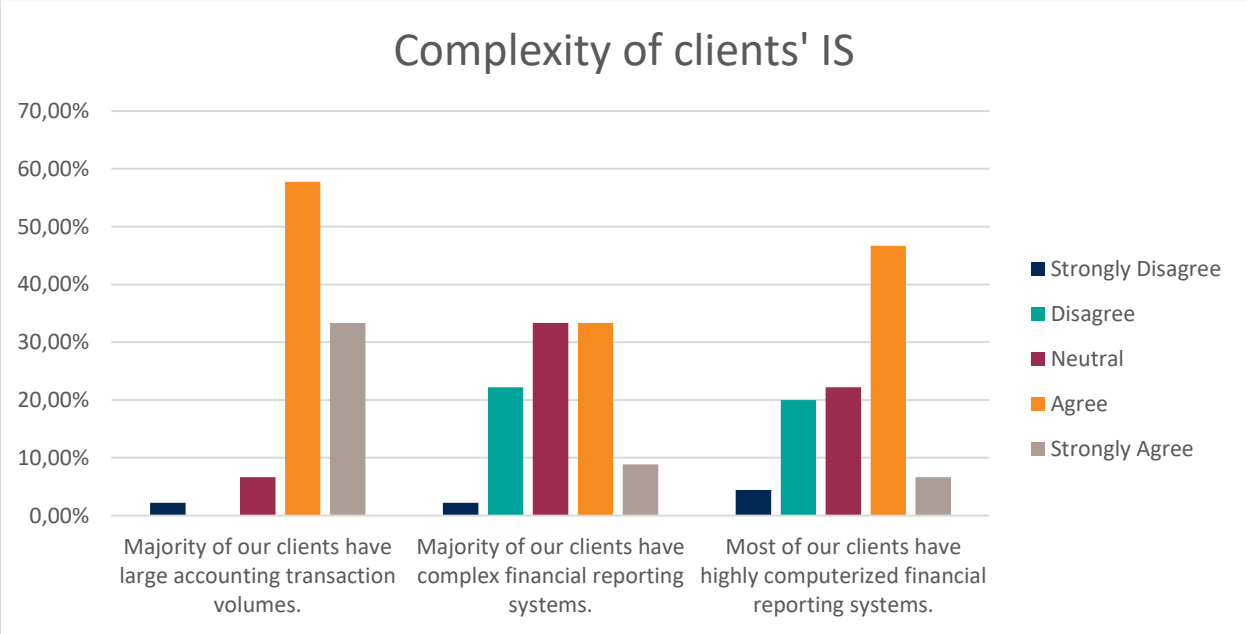


Figure 4-10: Responses on complexity of clients' IS

4.4.3 Perceived level of professional body support

As indicated earlier in the literature of the study, most SAIs subscribe to either national or international professional bodies like INTOSAI, AFROSAI, AFROSAI-E and many others that provide guidance and support. The support can come in forms such as standards and frameworks. Figure 4-11 indicates responses on this matter.

A total of 4% of the respondents disagreed that professional bodies to which they are affiliated support technology adoption. A total of 13% of the respondents neither agreed nor disagreed. However, 60% and

22% of the respondents respectively agreed and strongly agreed that professional bodies support technology adoption.

On the question of whether auditing standards that are set up by professional bodies support technology adoption, 2% agreed with the notion while 11% of the respondents were not sure. A total of 78% and 9% of the respondents agreed and strongly agreed that the standards developed support technology adoption.

Furthermore, 2% of the respondents disagreed that professional accounting bodies highly recommend technology adoption. A total of 22% of the respondents neither agreed nor disagreed. 60% and 16% of the respondents agreed and strongly agreed respectively that the professional accounting bodies recommend technology adoption.

On whether professional accounting bodies provide incentives for SAIs to adopt technology, 9% and 13% of the respondents strongly disagreed and disagreed. A total of 49% of the respondents were not sure while 24% and 4% of the respondents agreed and strongly agreed respectively that incentives are provided.

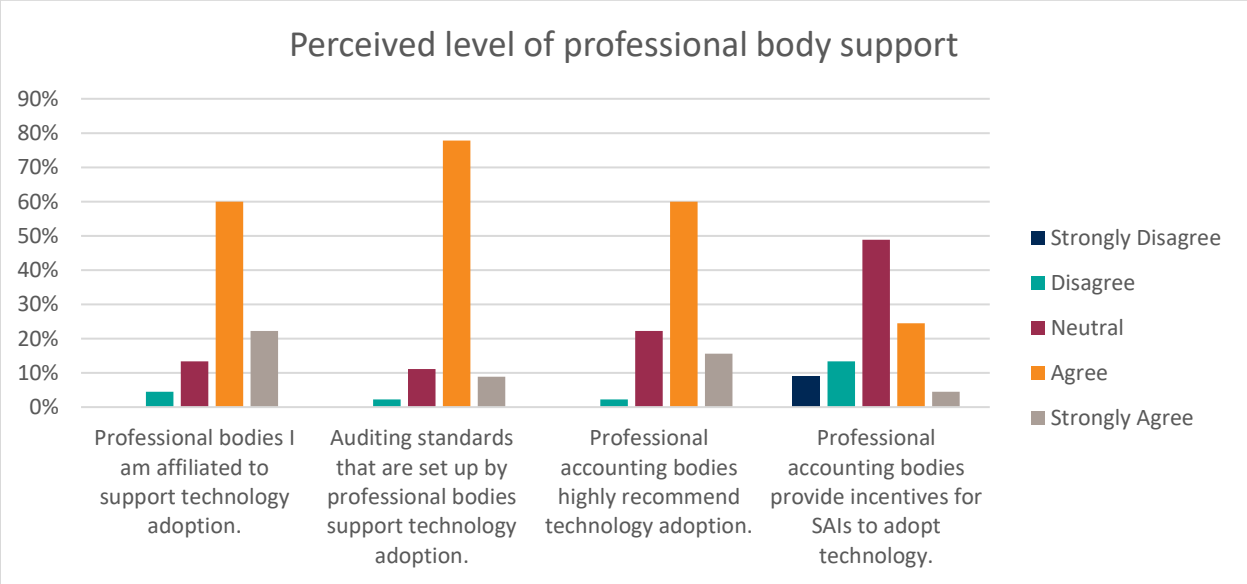


Figure 4-11: Responses on perceived level of professional body support

4.4.4 Voluntariness of technology adoption

On the issue of voluntariness, a total of 22% of the respondents disagreed that adoption of technology by the SAI is voluntary. Further to this, a total of 22% of the respondents neither agreed nor disagreed while

44% and 11% of the respondents agreed and strongly agreed respectively with the statement above (Figure 4-12).

Nonetheless, 13% of the respondents disagreed that it is not compulsory for their SAI to adopt any technology, even if it might add value and 27% of the respondents were not sure. A total of 44% and 15% of the respondents agreed and strongly agreed respectively that it is not compulsory though technology would add value.

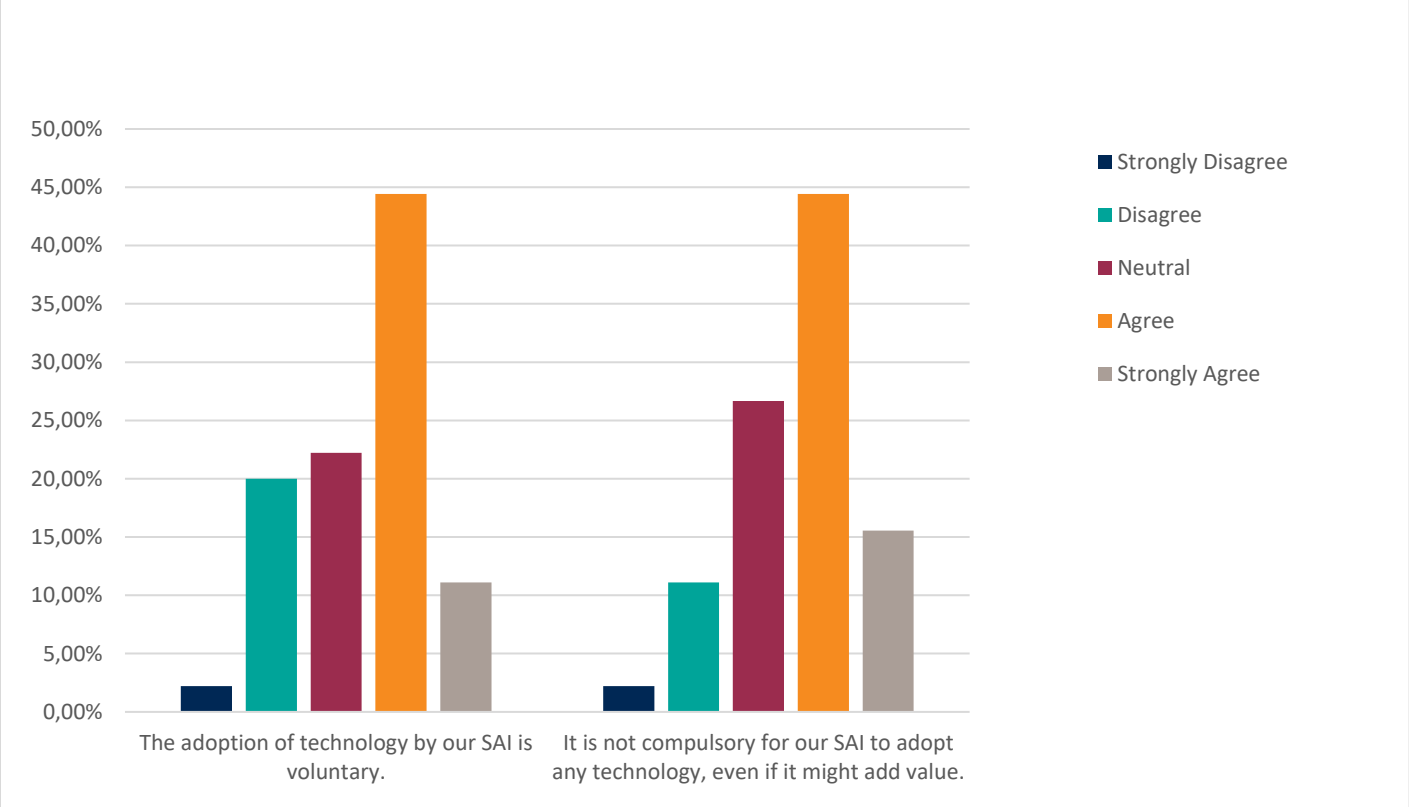


Figure 4-12: Responses on voluntariness of technology adoption

4.5 How audit automation influences quality of audit

Figure 4-13 and Figure 4-14 show responses on whether automation influences quality of the audit. A total of 5% of the respondents disagreed (2% strongly disagreed and 2% disagreed) that automation in audit has brought more consistency in audit. A total of 14% of the respondents expressed a neutral opinion while 55% and 27% of the respondents respectively agreed and strongly agreed that there is consistency due to automation.

A total of 2% and 9% of the respondents strongly disagreed and disagreed respectively that automation enhances auditors' values, ethics and attitudes and monitoring of the same. A total of 14% of the respondents were not sure while 59% and 16% agreed and strongly agreed with the statement above.

Regarding automation enhancing the performance of audit work, none of the respondents disagreed while 5% were not sure. However, 61% and 34% of the respondents agreed and strongly agreed respectively.

A total of 2% of the respondents disagreed that automation ensures rigorous audit process and quality control procedures that comply with laws, regulations and applicable standards. However, 7% of the respondents expressed neutral opinions while 55% and 36% of the respondents agreed and strongly agreed respectively.

None of the respondents disagreed that automation helps deliver more useful and timely reports. A total of 5% were not sure while 48% of the respondents agreed and 48% strongly agreed that timely reports are delivered due to automation.

A total of 2% and 7% of respondents respectively strongly disagreed and disagreed that automation enhances auditors' interactions with relevant stakeholders. A total of 14% of respondents were not sure while 55% and 23% of respondents agreed and strongly agreed respectively.

In the case of automation increasing efficiency, saving money (with paper saving, for example) and time (with automatic file sharing and synchronization, for example), none disagreed. However, 9% of respondents expressed neutral opinions while 36% and 55% of respondents agreed and strongly agreed with the above statement respectively.

None of the respondents disagreed that automation enhances the documentation of audit work. However, 2% of respondents expressed neutral opinions on this while 39% and 59% of the respondents agreed and strongly agreed that automation enhances audit work documentation.

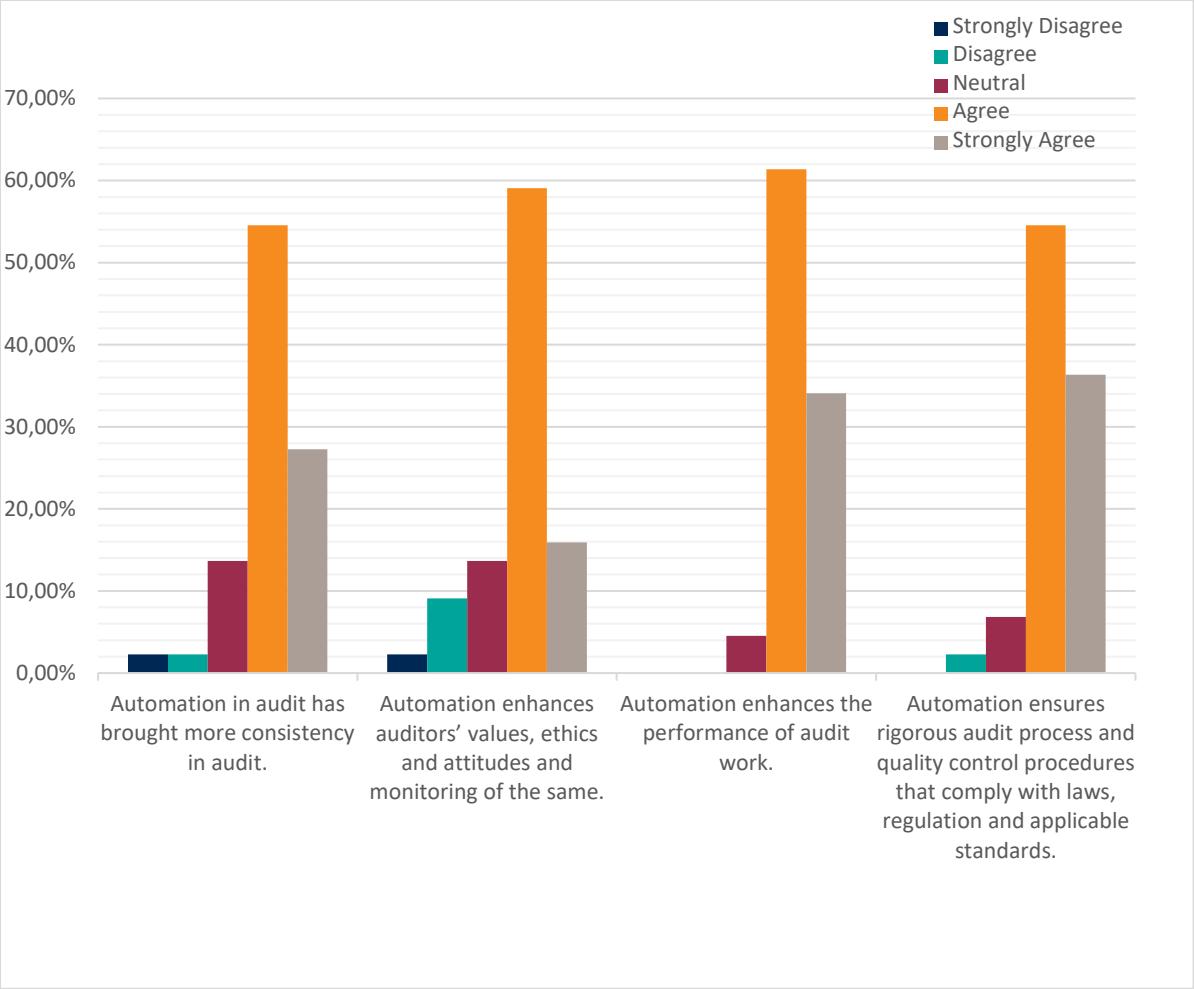


Figure 4-13 Responses on whether automation influences quality of the audit

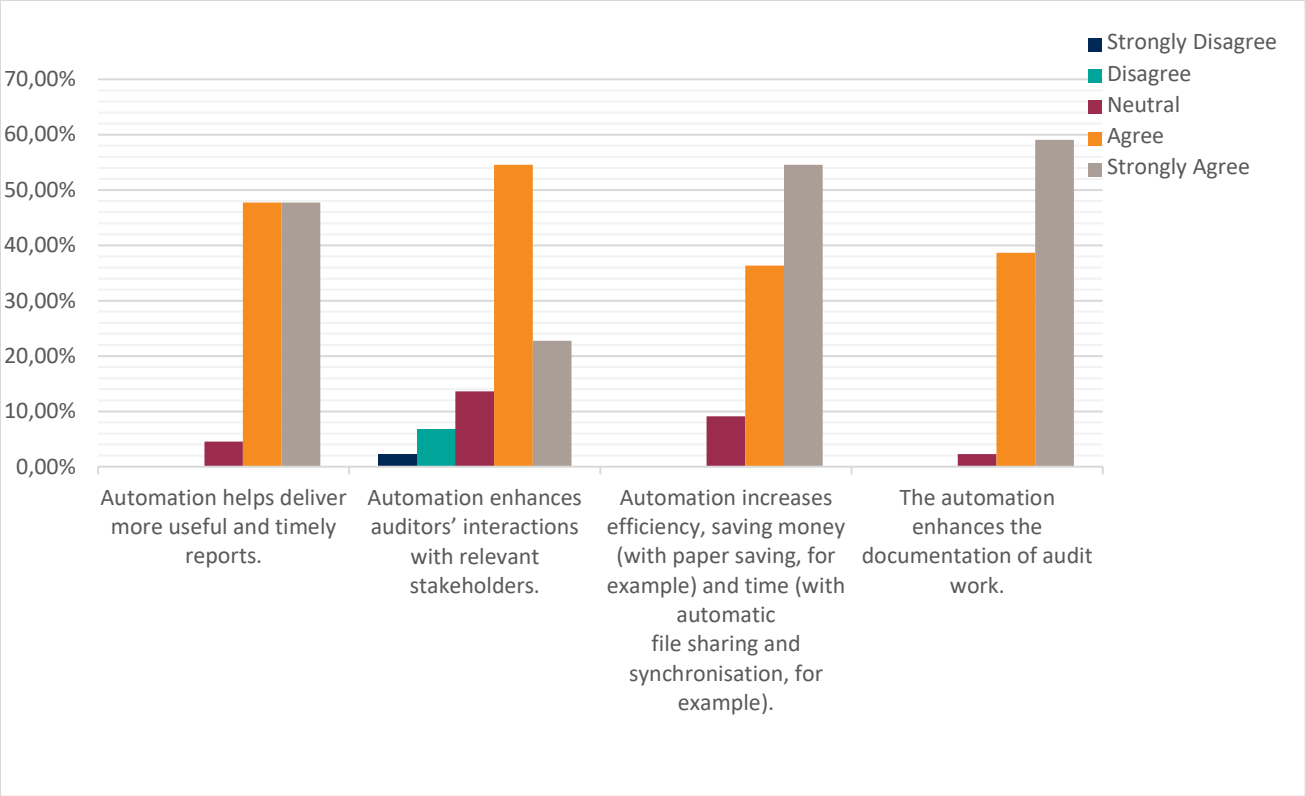


Figure 4-14 Responses on whether automation influences quality of the audit

4.6 Reliability

The study consisted of five constructs that included technological factors, organisational factors, environmental factors, technology adoption and audit quality as shown in Table 3. It should be noted that the number of items (in each construct in Table 3) corresponds to the number of questions that were asked in each construct.

The reliability of the constructs was measured using Cronbach's alpha. According to Malhotra (2011),[57] Cronbach's alpha coefficient of less than 70% theoretical threshold represents an unsatisfactory level of internal consistence while Cronbach's alpha coefficient of more than 70% is acceptable.

It can be observed that all the constructs measured in this study had Cronbach's alpha that was greater than the 70% minimum threshold. In particular, organisational factors and audit quality scales had excellent internal consistency with high and acceptable Cronbach's alpha values of 92,3% and 87,2%

[57] Malhotra, R. 2011. Empirical Research in Software Engineering: Concepts, Analysis, and Applications. Florida, CRC Press

respectively. An overall Cronbach's alpha of 91,8% was achieved in this study as shown in Table 3. This is a particularly good overall level of internal consistence which is above the minimum theoretical requirement of 70%. This means that there was a high level of consistency in the way the questions were formulated in the questionnaire for the study. None of the questions were redundant to measure the construct under consideration.

Table 3: Reliability of the instrument using Cronbach's alpha

Construct	No. of items	Alpha value %
Technological factors	12	70,1
Adoption of audits	3	71,2
Organisational factors	13	92,3
Environmental factors	11	85,0
Audit quality	8	87,2
Overall	**47**	**91,8**

4.7 Inferential statistics on technology adoption at SAIs

This part of the report presents relevant inferential statistics which helps to address the main research questions posed earlier. The relationships between technological factors, organisational factors, environmental factors, technology adoption and audit quality were analysed with reference to correlation analysis and multiple regression. Table 4 shows association between variables under investigation using Pearson correlation analysis.

The correlation coefficient ranges from -1 to +1. A correlation value of 0 between two variables implies that there is no relationship between the variables in question. Coefficient values between 0 and 0.35 indicate weak or low relationship, 0.36 to 0.67 moderate, 0.68 to 1.0 indicate strong correlation between variables concerned.[58]

Association between technological factors and technology adoption was positive and moderate with a correlation coefficient of 0.492 which was significant ($p < 0.05$). Association between organisational factors and technology adoption was positive, weak and not significant ($p > 0.05$) with a correlation coefficient of 0.304. Similarly, an association between environmental factors and technology adoption was positive, weak and not significant ($p > 0.05$) with a correlation coefficient of 0.329. Finally, an association between audit quality and technology adoption was positive, moderate and significant ($p <$

[58] Taylor, R. 1990. Interpretation of the correlation coefficient. A Basic Review. JDMS, 1:35-39

0.01) with a correlation coefficient of 0.593. The above results are a reflection that even though environmental and organisational factors are positively aligned to technologies adopted by SAIs, the level of association of these factors is not profound.

Table 4: Relationship between variables using correlation analysis

Variables		A	B	C	D	E
Technological factors, A	Correlation	1	.488**	0.264	0.492**	0.157
	Sig.		0.001	0.08	0.00	0.307
	N	46	46	45	46	44
Organisational factors, B	Correlation	.488**	1	.355*	.304	.410**
	Sig.	0.001		0.017	0.24	0.006
	N	46	46	45	46	44
Environmental factors, C	Correlation	0.264	.355*	1	.329	.586**
	Sig.	0.08	0.017		0.27	0
	N	45	45	45	45	44
Technology adoption, D	Correlation	0.492**	.304	.329	1	.593**
	Sig.	0.00	0.24	0.27		0
	N	46	46	45	46	44
Audit quality, E	Correlation	0.157	.410**	.586**	.593**	1
	Sig.	0.307	0.006	0	0	
	N	44	44	44	44	44

The objectives of the study were resolved using multiple regression as shown in Table 5. Technology adoption was the dependent variable while environmental factors, organisational factors and technological factors were independent variables. Prior to regression analysis collinearity statistics was analysed to confirm if independent variables mentioned above were not closely associated with each other. Independent variables that are closely associated with each other can hardly predict the value of the dependent variable. Multicollinearity is not desirable in regression analysis as it creates instability in regression estimates causing high standard errors. Therefore, existence of multicollinearity should be analysed and corrected if there is a need. Variance Inflation Factor (VIF) and Tolerance are two commonly used parameters to measure the level of multicollinearity.

According to Saunders (2016), a Variance Inflation Factor, VIF of above 4 or tolerance below 0.25 indicates that multicollinearity probably exists. Furthermore, when VIF is higher than 10 and tolerance is lower than 0.1, there is significant multicollinearity that must be corrected. Based on results in Table 5, VIF and tolerance levels were within limits (in all independent variables) indicating that there was no significant multicollinearity that had to be corrected.

4.7.1 Hypothesis testing

To answer the main objectives of the study, hypothesis testing was employed. A multiple regression model in Table 4 was used to test the influence of environmental factors, organisational factors and technological factors on technology adoption.

a) Hypothesis 1

H0: Technological factors have no significant influence on the technologies SAIs adopt for audits.
H1: Technological factors have significant influence on the technologies SAIs adopt for audits.

Based on the multiple regression model in Table 5, it can be observed that the p value of the coefficient of technological factors was less than 0.05 ($p < 0.05$). H0 is rejected and hence it can be concluded that technological factors have a significant influence on the technologies SAIs adopt for audits. The coefficient of technological factors was positive ($\beta = 0.41$, $p < 0.05$) demonstrating a direct and synchronized relationship between technological factors and technology adoption. These results serve to confirm the probability that SAIs' adopted technologies are influenced by technological elements such as compatibility, technological complexity and technological cost benefit.

b) Hypothesis 2

H0: Organisational factors have no significant influence on the technologies SAIs adopt for audits.
H2: Organisational factors have a significant influence on the technologies SAIs adopt for audits.

The p value of the coefficient of organisational factors was more than 0.05 ($p > 0.05$) as shown in Table 5. H0 is NOT rejected and hence it can be concluded that organisational factors have no statistically significant influence on the technologies SAIs adopt for audits. The coefficient of organisational factors was positive ($\beta = 0.237$, $p > 0.05$) signifying a coordinated relationship between organisational factors and technology adoption.

This result could be a reflection that the impact of organisational elements such as SAIs' top management commitment, SAI employees' competence and SAIs' organisational readiness have not reached desired levels to influence technologies SAIs adopt for audits. The result could also be because SAIs outsource IT services.

c) Hypothesis 3

H0: Environmental factors have no significant influence on the technologies SAIs adopt for audits.
H3: Environmental factors have a significant influence on the technologies SAIs adopt for audits.

The p value of the coefficient of environmental factors was more than 0.05 ($p > 0.05$) as shown in Table 5. H0 is NOT rejected and hence it can be concluded that environmental factors have no significant influence on the technologies SAIs adopt for audits. The coefficient of environmental factors was positive ($\beta = 0.266$, $p > 0.05$) indicating a positive relationship between environmental factors and technology adoption.

These results could be a reflection of the probability that SAIs' external environment such as compliance with government regulations, complexity of clients' IS and professional bodies' support have not attained preferred levels that can successfully support new IT innovations for audits. The result on government regulation could also be because SAIs are to a large extent operationally independent and the SAIs' decision to adopt technology is not influenced by government regulation. On complexity of clients' IS, this may be because SAIs are legally mandated to undertake audit regardless of the nature or complexity of systems adopted by its clients.

Table 5: Influence of environmental factors, organisational factors and technological factors on technology adoption using regression

Variables	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	3.081	.660		4.417	.000		
Technology factors	.029	.169	.410	.341	.022	0.728	1.374
Organisational factors	.201	.123	.237	1.379	.163	0.684	1.462
Environmental factors	.223	.134	.266	1.521	.113	0.865	1.156

The standardized weights of the influence of environmental factors, organisational factors and technological factors on technology adoption are shown in Table 6. Technological factors had the largest influence on adoption of technologies with the highest weight of 44,9% followed by environmental factors with a weight of 29,1%. The influence of organisational factors on adoption of technologies had the lowest weight of 26,0%.

Table 6: Standardized weights of independent variables

Variables	Standardized Beta	Weight	Weight %
Technological factors	0.410	0.449	44.9
Organisational factors	0.237	0.260	26.0
Environmental factors	0.266	0.291	29.1
Total	**0.913**	**1.000**	**100.0**

4.7.2 Model validation

Analysis Of Variance (ANOVA) was used to measure the goodness of fit of the regression model above. The p value of the regression model was less than the 5% level ($p < 0.05$). This means that the model is significant and that the dependent variable, technologies SAIs adopt for audits, is well defined in terms of environmental factors, organisational factors and technological factors (Table 7).

Table 7: A measure of regression model adequacy using Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.707	3	.569	4.215	.048
	Residual	9.661	41	.236		
	Total	11.368	44			

The R^2 value of 0.508 of the model is fairly moderate, indicating that 50,8% of the variance in the technologies SAIs adopt for audits is explained by environmental factors, organisational factors and technological factors (Table 8). This confirms that the regression model is fairly accurate and can be used to predict technologies SAIs adopt for audits by using environmental factors, organisational factors and technological factors as independent variables.

Table 8: Measure of model adequacy using R^2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.7124	0.5075	0.2973	0.4854

4.7.3 Moderating variables

To test if voluntariness significantly moderates the relationship between government regulations, GVTREG and SAIs' decision to adopt technology, a regression model was run in SPSS software application as shown in Table 9. The interaction factor 1 (a product of Voluntariness and Government Regulations) was not significant. However, Variance Inflation Factor was way above upper bound of 4, indicating existence of significant multicollinearity which provides spurious results on moderation. This means that the significance of the findings of the study which are based on the regression model will be highly inaccurate if multicollinearity is not appropriately addressed. Specifically, the existence of high multicollinearity in this case can lead to a wrong conclusion on the significance of the moderating factor.

Table 9: Voluntariness as a moderator for government regulations and adoption of technology

	Standardized coefficients	**t**	**Sig.**	**Collinearity statistics**	
	Beta			Tolerance	VIF
(Constant)		0.003	0.998		
GVTREG	1.561	2.001	0.052	0.033	29.986
Voluntariness	1.640	1.712	0.094	0.022	45.222
Interaction1	-1.905	-1.608	0.115	0.014	69.116

To correct for high multicollinearity which is indicated by large VIF values that are greater than a standard threshold of 4 (as shown in Table 9), government regulations, technology adoption and associated interaction were first standardized prior to running the regression model. The results of standardized variables and associated interaction are shown in Table 10. It is observed that Variance Inflation Factors for standardized government regulations, technology adoption and associated interaction were within limit of less than 4, confirming insignificance or nonexistence of multicollinearity.

Therefore, since Interaction2 (a product of standardized values of voluntariness and government regulations) was not significant, it can be concluded that voluntariness does not have a significant ($p > 0.05$) impact on the relationship between government regulations and adoption of technology.

Table 10: Voluntariness as a moderator for government regulations and adoption of technology using standardized variables

Variables	Standardized coefficients	t	Sig.	Collinearity statistics	
	Beta			Tolerance	VIF
(Constant)		63.152	0.000		
Zscore (GVTREG)	0.381	2.597	0.013	0.944	1.059
Zscore (Voluntariness)	0.197	1.300	0.201	0.886	1.128
Interaction2	-0.247	-1.608	0.115	0.858	1.165

Voluntariness, professional body affiliation and interaction effect, interaction3 were standardized and this helped to significantly reduce multicollinearity to within upper bound of 4 when using VIF as shown in Table 11. It is observed that interaction3 was significant ($p < 0.1$). It can therefore be concluded that voluntariness has a significant impact on the relationship between professional body affiliation/support and SAIs' decision to adopt technology. This means that the relationship between complexity of clients' IS and professional body affiliation/support and SAIs' decision to adopt technology is significantly impacted by voluntariness.

Table 11: Voluntariness as a moderator for professional body affiliation/support and SAIs' decision to adopt technology using standardized variables

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.543	.071		63.604	.000		
	Zscore (ProFBSuP)	.185	.074	.364	2.512	.016	.958	1.044
	Zscore (Voluntariness)	.151	.090	.296	1.678	.101	.647	1.546
	Interaction3	-.143	.078	-.327	-1.835	.074	.634	1.577

4.7.4 Investigation of the influence of audit automation on quality

d) Hypothesis 4

H0: Audit automation has no significant influence on the quality of audit.
H4: Audit automation has a significant influence on the quality of audit.

The influence of audit automation on quality of audit was addressed with reference to regression model as shown in Table 12. It is observed that Variance Inflation Factor was less than an upper bound of 4 and

tolerance was above 0.25. This is indicative that existence of multicollinearity was insignificant. The coefficient of audit automation in the regression model was less than 0.01 ($p < 0.01$). H0 is rejected and hence it can be concluded that audit automation has a significant influence on the quality of audit. Thus, automation is one of the significant drivers of the quality of audit.

Table 12: Analysis of influence of audit automation on quality of audit using regression

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.383	.596		2.321	.025		
	Audit automation	.620	.130	.593	4.772	.000	1.000	1.000

The influence of technological compatibility (TC), technological complexity (TCX), technological cost benefit (TCoB), top management commitment (TMGCoM), employees' IT competence, organisational readiness, government regulations (GVTREG), perceived level of professional body support (ProFBSuP) and complexity of clients' IS systems (CCIS) on the technologies SAIs adopt for audits was measured using regression (Table 13). The above-mentioned variables were independent variables while technologies SAIs adopt for audits was a dependent variable.

It is observed that Variance Inflation Factor was less than an upper bound of 4 and tolerance was above lower limit of 0.25. This demonstrates that the existence of multicollinearity was insignificant. It is further observed that technological compatibility (TC), technological complexity (TCX), level of professional body support (ProFBSuP), technological cost benefit (TCoB) and top management commitment (TMGCoM) had a significant ($p < 0.05$) influence on the technologies SAIs adopt for audits. This means that the above-mentioned elements are drivers with profound impact on the technologies SAIs adopt for audits. However, there was no statistical evidence to suggest that employees' competence, organisational readiness, government regulations (GVTREG) and complexity of clients' IS systems (CCIS) significantly ($p > 0.05$) influence the technologies SAIs adopt for audits.

Table 13: Analysis of influence of technological, human and policy factors on technologies SAIs adopt for audits using regression

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.271	.816		4.009	.000
	TC	-.089	.105	-.141	-.840	.046

	TCX	-.123	.101	-.184	-1.215	.033
	TCoB	.192	.110	.300	1.738	.041
	TMGCoM	.073	.151	.118	.484	.032
	Competency	.304	.183	.329	1.662	.105
	Organisational readiness	-.271	.176	-.347	-1.535	.134
	GVTREG	.138	.118	.198	1.168	.251
	CCIS	-.069	.125	-.100	-.551	.585
	ProFBSuP	.128	.169	.145	.760	.045
Dependent variable: ADOPTechno						

The p value of the regression model was less than the 5% level ($p < 0.05$) as shown in Table 14. This means that the model is significant and that the dependent variable, technologies SAIs adopt for audits, is well defined in terms of technological compatibility (TC), technological complexity (TCX), technological cost benefit (TCoB), top management commitment (TMGCoM), professional body support, employees' IT competence, organisational readiness, government regulations (GVTREG) and complexity of clients' IS systems (CCIS).

Furthermore, an R^2 value of 0.504 is fairly moderate, indicating that 50,4% of the variance in the technologies SAIs adopt for audits is explained by technological compatibility (TC), technological complexity (TCX), technological cost benefit (TCoB), top management commitment (TMGCoM), employees' competence, professional body support, organisational readiness, government regulations (GVTREG) and complexity of clients' IS (CCIS).

Table 14: Validation of regression model using ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.487	9	.499	2.536	.023[a]
	Residual	6.881	35	.197		
	Total	11.368	44			

Hypotheses that were formulated and tested using multiple regression to answer the objectives of the study are summarised in Table 15.

Table 15: Summary of hypothesis testing

Objectives	Null hypothesis	Results	Statistical significance	Conclusion
Objective 1	Technological factors have no significant influence on the technologies SAIs adopt for audits	Rejected	**	Technological factors have a significant influence on the technologies SAIs adopt for audits
Objective 2	Organisational factors have no significant influence on the technologies SAIs adopt for audits	Accepted	NS	Organisational factors have no significant influence on the technologies SAIs adopt for audits
Objective 3	Environmental factors have no significant influence on the technologies SAIs adopt for audits	Accepted	NS	Environmental factors have no significant influence on the technologies SAIs adopt for audits
Objective 4	Voluntariness does not have an impact on the relationship between government regulations and adoption of technology	Accepted	NS	Voluntariness does not have an impact on the relationship between government regulations and adoption of technology
Objective 5	Voluntariness does not have an impact on the relationship between complexity of clients' IS and professional body affiliation/support and SAIs decision to adopt technology	Rejected	*	Voluntariness has a significant impact on the relationship between complexity of clients' IS systems and professional body affiliation/support and SAIs' decision to adopt technology
Objective 6	Audit automation has no significant influence on quality of audit	Rejected	***	Audit automation has significant influence on quality of audit

NS=not significant; *= $p < 0.1$; ** = $p < 0.05$; *** = $p < 0.01$

5 CONCLUSION AND RECOMMENDATIONS

This section of the study provides a conclusion and recommendations on the research questions.

5.1 Conclusion and discussion

The aim of this paper was to identify factors to be considered when a SAI adopts technology and the effect of technology adoption on audits. The research was based on the TOE framework that recommends three categories of factors which affect technology adoption by organisations, namely technological, organisational and environmental factors.

Analysis of Variance (ANOVA) showed the model is accurate and can be used to predict technologies SAIs adopt for audit. A measure of contribution of each factor as measured using standardized weights showed that technological factors had the highest weight at 44,9% followed by environmental factors with 29,1%. Organisational factors had the least weight at 26%.

All three the technological factor variables – technological compatibility, technological complexity and technological cost benefit – we found to have a significant effect on technology adoption.

Our result with respect to organisational factors (top management commitment, SAI employees' IT competency and organisational readiness) showed that the organisational factors construct was not statically significant. Further testing of individual elements however found top management to have a significant effect on technology adoption. The reason why SAI employees' IT competency is not consistent as in other prior studies might be because SAIs are allowed by the enabling legislations to outsource. We did not have any explanation for the unexpected result of organisational readiness not being significant in influencing technology adoption.

The environmental factor construct (government regulations, complexity of clients' IS and perceived level of professional body support) was also not statistically significant. However, a test of individual elements found the perceived level of professional body support to be statistically significant. We did not find government regulation to have a significant influence on technology adoption. The result on government regulation could be because SAIs are to a large extent operationally independent and thus the respondent might have felt that the SAI's decision to adopt technology is not influenced by government regulation. Complexity of clients' IS was also not found to be significant. This may be because SAIs are legally mandated to undertake audit regardless of the nature or complexity of systems adopted by its clients.

It was also found that voluntariness had a moderating effect in explaining the influence of perceived level of professional body support on technology adoption.

The study also found technology adoption had a significant influence on the quality of audit undertaken by SAIs.

5.2 Recommendations

This study recommends that SAIs should consider automating their processes by adopting technologies, as adoption of technology was found to enhance quality of audit. In addition, when considering the technology to adopt, the study recommends:

1) SAIs to place more emphasis on the factors of technological complexity, technological compatibility and technological cost benefit in deciding what technologies to adopt.

SAIs should consider adopting technologies that users consider easy to use, they should also consider whether the technology they intend to adopt is compatible with already existing technologies owned by the SAI itself and by its clients. In addition, a thorough cost benefit analysis should be carried out to ensure that an appropriate new technology that is cost effective considering the initial outlay and maintenance costs is selected. The idea is that the new technology should be beneficial to the SAI in the long term in terms of efficiencies derived from its use. SAIs need to take into consideration the sustainability of using the adopted technology.

2) Ensure top management support

Top management buy-in is critical because they have the capacity to facilitate structural, procedural and cultural changes in an organisation to enable successful adoption of new technology.

Even though new technology adoption is a strategic project that requires the attention of top management, commitment and support is essential for visibility, efficiency and effective planning and roll out. Top management is responsible for providing the guidance and leadership that can guarantee project success. Top management helps new technology adoption through providing adequate resources such as finance, tools and equipment and skilled manpower.

3) Take professional body guidelines into consideration.

SAIs should take into consideration guidelines/recommendations issued by professional bodies/affiliation in deciding on technologies to adopt. Professional bodies/affiliation can also provide forums for benchmarking and incentives such as training of which SAIs should take advantage.

In addition to the above, the following can also be considered:

a) Investment in new technology

Prior to investing in new technology, it is important for SAI management to understand the market (of suppliers and clients) in terms of technological advancements. This helps in the selection of an appropriate technology that is in line with the SAI's needs. Investments in new technology should be considered in the SAI's overall risk management process.

b) Perform a current systems analysis

A thorough systems analysis needs to be done within SAIs' establishments to understand technological, compliance and organisational deficiencies which are inhibiting success. This analysis will help to make informed decisions on what to prioritise to buy and set up to achieve desired levels of impact of technology adoption.

There are several existing tools, like the EUROSAI ITSA or SAI ITMA, that the SAI may use for this analysis. It is also recommended that this happens as part of the overall office assessment or strategic review. This will ensure alignment of IT goals to overall organisational goals.

c) Organisational readiness

SAIs should have adequate financial, human and other resources to support new technology. These should be able to cover IT resources to support usage of adopted technologies, IT facilities needed to adopt technologies, as well as the training of staff.

d) Alignment of technologies with internal capabilities

It is advisable that SAIs' internal capabilities such as human resource and IS capabilities, organisational IT infrastructure, organisational working culture and readiness towards adopting new technologies are compatible and matched. This facilitates smooth flow of new technologies which can then easily support business operations.

For example, a SAI deciding on which operating system or application to buy may be guided by availability of expertise in that application. Where there may not be expertise, the SAI should have plans to either build/source/bring in this expertise.

e) Competencies

SAIs' employees, particularly technical staff, should continually undergo job learning and training to develop their competencies at work. Furthermore, training courses, relevant seminars and conferences should be given priority for employees.

f) Integrate technology deployment with change management

Technology adoption needs to be supported by human behaviour and attitude. For this reason, change management plays a critical role in ensuring that SAIs' employees are ready for new technological innovation, if any success is to be achieved.

g) Governance structure

SAIs' establishments need to create effective governance structure that will ensure that there is compliance with environmental policies, quality standards, reporting standards, audit standards, performance and other government rules and regulations. Positioning of IS management should enable the function to be a strategic enabler and add value to the SAI.

h) Technological and strategic alignment

SAIs' establishments need to effectively align technology and its broader strategy. This ensures that technological, organisational and environmental factors are optimally focused on driving automation for auditing within the organisation.

i) Alignment of technologies with clients being audited

It is advisable that SAIs' adopted technologies are aligned with technologies implemented by the clients being audited. This removes risks of mismatch which is disruptive to operations of the SAI and its clients.

For example, when purchasing a data analysis tool, the SAI may consider the ability of that tool to extract data from the main databases audited and its ability to handle the data formats from there.

j) Alignment of technologies with external environment

It is advisable that SAIs' management study and understand the external environment so that new IT innovation projects can easily comply with such an environment. Compliance with government regulations should be given priority. Understanding of other SAIs or similar organisations, the complexity of clients' AIS and vendor systems is essential.

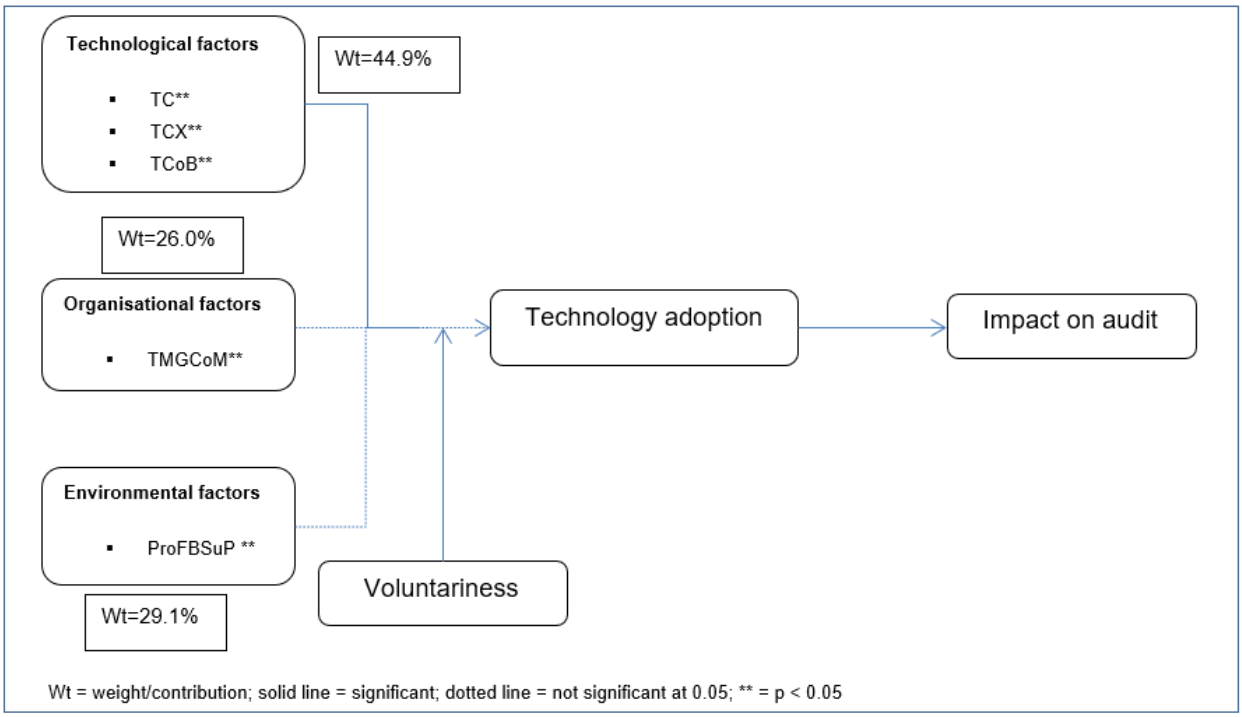
6 CONTRIBUTION

The primary objective of this study was to establish the key factors that have been used by SAIs in deciding on technologies to adopt and the impact of automation in audit. The factors were classified into two layers. The upper layer tested the significance of the impact of technological factors, organisational factors and environmental factors on technology adoption. Furthermore, the impact of technology adoption on audit quality was tested using multiple regression analysis. The second layer tested the significance of the impact of detailed elements of technological factors, organisational factors and environmental factors on technology adoption.

The findings indicated that technological compatibility (TC), technological complexity (TCX), level of professional body support (ProFBSuP) and top management commitment (TMGCoM) have a significant ($p < 0.05$) influence on the technologies SAIs adopt for audits. On the upper level, the findings showed that technological factors had a statistically significant impact on technology adoption decisions, while organisational factors and environmental factors had an impact that was not statistically significant. Technological factors had the largest impact with the highest weight of 44,9% while the impact of organisational factors was ranked second with a weight of 26,0%. However, the influence of environmental factors had the lowest weight of 29,1%. On the relationship between technology adoption and quality of audits, it was found that technology adoption had a significant influence on the quality of audit.

The validated model which demonstrates key factors that have been used by SAIs in deciding on technologies to adopt and the impact of automation in audit is shown in Table 16. The dotted lines indicate non-significance of the influence of the factor in question (at 0.05 level of significance). Solid lines indicate significant relationships between two factors as shown. The weights (which are derived from the standard beta values from regression model) indicate the extent of the influence of a factor on technologies to adopt.

Table 16: Validated model of the study


Technological factors
TC**
TCX**
TCoB**
Wt=44.9%
Wt=26.0%
Organisational factors
TMGCoM**
Technology adoption
Impact on audit
Environmental factors
ProFBSuP **
Voluntariness
Wt=29.1%
Wt = weight/contribution; solid line = significant; dotted line = not significant at 0.05; ** = p < 0.05

7 APPENDICES

7.1 Appendix 1 – Survey questionnaire

Questionnaire - SAI Automation & Techno