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ESSAYS ON INNOVATIONS IN
PUBLIC SECTOR AUDITING

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Thesis Abstract
Essays on Innovations in Public Sector Auditing.

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The current antecedents of innovation in the public sector, that is, the adoption of SDGs and the unprecedented technological advancements exert pressures on the Supreme audit institutions'(SAIs) current socio-technical system. This has led SAIs to adopt different strategies to maintain their relevance and improve the quality of their work and operations. This thesis investigated the different types of innovations currently happening in the SAIs environment and how SAIs are reacting to the demands of these changes. This exploratory work captured public sector audit innovation through the following three essays:

The first essay focused on Digital Transformation (DT), investigated how SAIs approach, and interpret DT. In this regard, DT was investigated from a SAIs perspective. Due to it being a novel topic in public sector auditing research, a qualitative research method was adopted, this method was supported with expert interviews and archival and or document data. Key findings revealed that the definition of DT varies from SAI to SAI, and this variation resulted from the differences in the level of digital development in each country. SAIs applied reactive and, in some situations proactive change strategies were applied. In the reactive strategy, SAIs reacted to change induced by a situational demand while in the proactive strategy, they experiment with technologies in advance. Most of the SAIs applying proactive change strategy operates an innovation lab or an experimentation space(see Bojovic, Sabatier, and Coblence 2020; Bucher and Langley 2016; Cartel, Boxenbaum, and Aggeri 2019; Wulf 2000). As an impact on public sector auditing profession, the research addresses the popular narrative of SAI's equating digitization or the use of digital technologies to Digital transformation. It reiterated the holistic nature of DT, by pointing at the risk involved when DT is tied solely to technology adoption strategy ignoring other aspects such as people, organizational structure, strategy, culture, etc.

The second essay examined a sub-item of DT, that is technology. In this essay, the focus was on the adoption of Data mining and analytics tools and Techniques (DMATTs). This research was largely motivated by the low adoption rate of these groups of technologies despite their sophisticated nature capable of assisting auditors audit in challenging environments such as public sector Big databases(Al-Sai and Abualigah 2017; Archenaa and Anita 2015; Löfgren and Webster 2020; Long et al. 2021; Munné 2016). Applying the dual-factor theory which takes into consideration the enablers and inhibitors of technology adoption decisions (Cenfetelli 2004; Tsai et al. 2019), this essay investigated the factors that might enable or inhibit SAIs from adopting DMATTs. The objectives and research questions warranted a quantitative research methodology,

Survey data was collected from 206 public sector auditors from SAI organizations with a history of using DMATTs verified through their publicly available audit reports. The collected data was analyzed using the PLS-SEM (Hair et al. 2012), producing the following findings: a) Technology-specific anxiety that is in this case DMATTs specific anxieties were more powerful than general computer anxiety in predicting adoption behavioral intentions towards a specific technology. They directly increase resistance while negatively affecting the intention to adopt. Thus, the construct of technology or computer anxiety should be crafted based on the nature and characteristics of the technology under investigation. b) DMATTs' anxieties negatively affected enabling factors such as ease of use and usefulness perceptions leading to the development of a negative attitude towards DMATTs and lessening the possibility to adopt DMATTs. The research was concluded with practice implications and recommendations on reducing anxiety and enabling the adoption of DMATTs.

The third and final essay(see figure 2), investigated a new audit technology called "SDG audits" (Le Blanc and Montero 2020; IDI[1] 2020; INTOSAI/IDI 2019). In this essay, the focus was on investigating the creation and institutionalization of this new practice, by first exploring what is SDG audit, then proceeded to its creation where it investigated the actors involved in the creation and what strategy they applied to institutionalize the new practice. The novelty of this topic motivated the adoption of a qualitative approach using institutional theories such as institutional entrepreneurship and institutional work as theoretical lenses. Basing the research on archival and interview data, it was found that, an SDG audit, is a hybrid performance audit created by combining performance audits logics and SDG logic (see IDI 2020), and was created through a collective effort as a tool to maintain the relevance of performance audits, that is it augments performance audits to suit the complexities(Marra 2021) and challenges in auditing the implementation of SDGs(Le Blanc and Montero 2020).

In conclusion, the three essays' paints a Picture of the public sector auditing profession to be an ever-evolving profession guided by the changes that occur in its environment.

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[1] https://www.idi.no/work-streams/relevant-sais/auditing-sdgs

Abstract
Ricerche sull'auditing e innovazione tecnologiche nel settore pubblico

La trasformazione in corso dell'ambiente esterno delle Istituzioni Superiori di Controllo (ISC, Corte dei conti) sta modificando le esigenze di controllo e le aspettative dei vari stakeholders coinvolti. Infatti, questa trasformazione, innescato dai progressi tecnologici, dall'adozione degli Obiettivi di Sviluppo Sostenibile (OSS) e dalla trasparenza sta modificando il modo e gli strumenti con cui viene esercitata l'attività di controllo. Ciò ha portato le ISC a adottare diverse strategie ed a introdurre diverse innovazioni per mantenere la loro rilevanza e migliorare la qualità del loro servizio. Vari autori hanno evidenziato la necessità di indagare circa le implicazioni del cambio della strategia di controllo e dell'adozione delle varie innovazioni tecnologiche nelle ISC. Il lavoro di tesi contribuisce in questa direzione e indaga sulle varie innovazioni tecnologiche adottate dalle ISC e come questi Istituzioni hanno reagito alle pressioni esterne di cambiamento. La tesi adotta un approccio esplorativo e sviluppa tre diverse ricerche per rispondere alla domanda principale di ricerca.

La prima ricerca si concentra sulla trasformazione digitale (TD), e indaga su come le ISC hanno affrontato e interpretato la TD. La metodologia utilizzata è di tipo qualitativo. Sono state effettuate varie interviste a esperti del settore a livello internazionale oltre all'analisi documentale degli archivi delle varie istituzioni analizzate. I risultati hanno mostrato una diversa interpretazione e percezione, tra le istituzioni oggetto dello studio, del concetto della TD, dovuta alle differenze di sviluppo digitale nei vari paesi analizzati. Inoltre, i risultati mostrano che le ISC hanno adottato strategie reattive di cambiamento e, in alcune situazioni, hanno adottato strategie proattive. Nel primo caso, che rappresenta la maggioranza dei casi analizzati, le ISC hanno reagito al bisogno ovvero quando si presenta una necessità di cambiamento. Mentre nel secondo caso, ovvero di strategia di cambiamento proattivo, le ISC hanno sperimentato le tecnologie in anticipo. La maggior parte delle Istituzioni che ha adottato strategie proattive di cambiamento gestisce un laboratorio di innovazione o uno spazio di sperimentazione (vedi Bojovic, Sabatier e Coblence 2020; Bucher e Langley 2016; Cartel, Boxenbaum e Aggeri 2019; Wulf 2000). Inoltre, la ricerca mostra come la digitalizzazione o l'uso delle tecnologie digitali vengono equiparati alla TD nelle ISC. Questo rischio di interpretazione del concetto si concretizza soprattutto, come mostrano i risultati, quando la TD viene legata esclusivamente alla strategia di adozione della tecnologia ignorando altri aspetti come le persone, la struttura organizzativa, la strategia, la cultura, ecc.

La seconda ricerca esamina un sotto-elemento di TD, ovvero uno degli ambiti di utilizzo della tecnologia. La ricerca focalizza l'attenzione sull'adozione degli strumenti e delle tecniche di data mining (STDM). Questa ricerca è stata motivata dal basso tasso di adozione di questa tecnologia (STDM) nonostante la sua capacità di assistere gli auditor nella revisione in ambienti sfidanti come quello del settore pubblico (Al-Sai e Abualigah 2017; Archenaa e Anita 2015; Löfgren e Webster 2020; Long et al. 2021;

Munné 2016). La ricerca utilizza la teoria dei due fattori che tiene in considerazione dei fattori abilitanti e quelli inibitori nella decisione di adozione della tecnologia di STDM (Cenfetelli 2004; Tsai et al. 2019) nelle ISC. È stato adottato un approccio quantitativo tramite l'utilizzo della survey, sono stati raccolti da 206 revisori del settore pubblico appartenenti alle ISC che utilizzano STDM. L'utilizzo del STDM è stato verificato attraverso i rapporti di revisione disponibili pubblicamente. I dati raccolti sono stati analizzati utilizzando il PLS-SEM (Hair et al. 2012). I risultati mostrano che l'intenzione di utilizzo dipende dall'ansia specifica della tecnologia, nel caso specifico l'ansia specifica di STDM, che risulta più rilevante rispetto all'ansia generale per l'utilizzo del computer. Pertanto, l'ansia tecnologica o informatica dovrebbe essere formulato in base alla natura e alle caratteristiche della tecnologia in esame. Inoltre, i risulta mostrano che l'ansia di utilizzo del STDM influenza negativamente i fattori abilitanti come la percezione di facilità d'uso e l'utilità, portando allo sviluppo di un'attitudine negativa verso STDM e diminuendo la possibilità di adottare la tecnologia.

La terza ricerca indaga sull'utilizzo, nelle ISC, di una nuova tecnologia di auditing chiamata "SDG audit" (Le Blanc e Montero 2020; IDI 2020; INTOSAI / IDI 2019). L'obiettivo della ricerca è quello di indagare circa l'ideazione e l'istituzionalizzazione di questa nuova pratica. È stato indagato, innanzitutto, sul significato del SDG audit, sulla sua ideazione e creazione, sugli attori coinvolti nella sua creazione. Infine, la ricerca ha esaminato la strategia di applicazione e di istituzionalizzazione di questa nuova pratica. La ricerca adotta un approccio qualitativo con l'utilizzo delle interviste e l'analisi documentale. È stato utilizzato un framework basato sull'approccio istituzionale. Nello specifico, è stata utilizzata la teoria dell'imprenditorialità istituzionale e del lavoro istituzionale per indagare circa l'utilizzo e la istituzionalizzazione della nuova pratica. I risultati mostrano che SDG l'audit è uno strumento ibrido di auditing creato combinando logiche di performance auditing e logiche di SDG (vedi IDI 2020). La tecnologia è stata creata e istituzionalizzata attraverso uno sforzo collettivo di vari attori. L'obiettivo della sua creazione è quello di mantenere la rilevanza del performance auditing, adattandolo alle nuove esigenze, alla complessità del contesto (Marra 2021) e alle sfide di attuazione degli obiettivi di SDG (Le Blanc e Montero 2020).

Le ricerche condotte contribuisco a migliorare il grado di conoscenza del processo di TD nelle ISC, e l'evoluzione della professione di auditing in relazione alle pressioni esterno di adottare nuove tecnologie.

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Chapter 1:

Essays on Innovations in Public sector audits: An introduction

Abstract

This chapter presents the background and summary of this dissertation, it starts by looking at innovations disrupting the public sector auditing external environment, then followed by an overview of how Supreme Audit institutions (SAIs) are reacting to these innovations. The final section of this chapter presents a summary of the three essays of this dissertation through which the exploration of public sector audit innovations where investigated.

Keywords: Supreme Audit institutions (SAIs), innovations, public sector auditing.

1. Introduction

Recently the public sector auditing profession is experiencing unprecedented changes, catalyzed by rapid Digital Transformation(DT) [2] and the adoption of the globally accepted 2030 Agenda for sustainability[3], this digital and sustainable transformation nexus is popularly known as the "Twin transition"[4](see Fanfalone and Celine Caira 2022; Fouquet and Hippe 2022; Frey 2021; Muench et al. 2022; Blüm 2022).

These twin transition is considered megatrends shaping the world (Brenner and Hartl 2021; Del Río Castro, González Fernández, and Uruburu Colsa 2021) and or, all aspects of our society. Lately, these trends have become buzzwords in the SAI community(INCOSAI 2019b). They are impacting and transforming the way SAIs audit, simply because these trends have impacted and transformed SAI's auditees, that is governments. According to the agenda 2030, each government is responsible for the implementation of the Agenda, this responsibility is usually operationalized through SDG localization(see Carbonell et al. 2023; ElMassah and Mohieldin 2020; Perry et al. 2021; Sicilia et al. 2016; Sylvia Croese and Susan Parnell 2022; Tiwari, Chauhan, and Varma 2021) that is integrating SDG into the local context of a country. The localization process usually requires the creation of special agencies, policy and budget reforms, new technologies, and sometimes the reorganization of public administration.

Governments following the Digital transformation trend, are evolving and transforming the ways they deliver public services or run public administration, they do so by leveraging smart technologies, these smart technologies [5] are enabling government transformation at an unprecedented rate(see Almuraqab 2021; Gil-Garcia, Zhang, and Puron-Cid 2016; Kankanhalli, Charalabidis, and Mellouli 2019; Wirtz, Weyerer, and Schichtel 2019; Witanto, Lim, and Atiquzzaman 2018).

The twin transformations are converging to propel a holistic innovation or change in

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[2] A strategic transformation in infrastructure and processes, as posited by Vial (2019)   "DT encompasses the profound changes taking place in society and industries through the use of digital technologies", Vial (2019),defined it as a continuous process "that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies" (p. 121)."

[3] On 25th of September 2015, the UN General Assembly adopted resolution A/RES/70/1" Transforming our world: the 2030 Agenda for Sustainable Development", a 15-year plan for global development guided UN member states developmental efforts. This document clearly breaks down the agenda in to 17 goals popularly known as Sustainable development goals (SDGs), and 168 targets. **Note:** For the sake of simplicity all through this thesis we will interchangeably use agenda 2030 and SDGs to mean the same, this a common practice. Download link: https://documents-ddsny.un.org/doc/UNDOC/GEN/N15/291/89/PDF/N1529189.pdf?OpenElement

[4] "While sustainability and digital transformation strategies are on the agenda for most organisations, few consider both together. Merging these strategies – *the Twin Transition* – brings real value and benefits. Choosing a Twin Transition accelerates sustainability goals through green IT (technology, data assets and infrastructures)". https://www2.paconsulting.com/twin-transition-playbook-request.html

[5] Some government especially those in technologically advanced nations have started experimenting and applying modern technologies such as the internet of Things (IoT). Today cities are also competing in the "smart city race", all these are in a bid to provide efficient public services to citizens.

the public sector (Osburg and Lohrmann 2017; Del Río Castro et al. 2021), for example, agenda 2030 brings on board a new philosophy[6] or content in the public sector which requires digital transformation to accelerate its realization, that is governments leverage smart technology in implementing and governing the implementation of SDGs.

Exant literature provides evidence of these twin transition concepts being mutually influential to each other. For example Wu and Raghupathi (2015), posited that ICT enables sustainability, and according to Wang, Chen, and Benitez-Amado (2015) the need for sustainability influences the deployment of IT, others have concluded that ICT can negatively or positively impact the environment, in other words, digital technologies may accelerate progress towards implementation and realization of SDGs(Brenner and Hartl 2021; Castro and Lopes 2021; Dwivedi et al. 2022; ITU n.d.; O'Sullivan et al. 2021), however without proper considerations, their implementation may lead to a digital divide(Frankenhauser 2021; Hidalgo et al. 2020; Tzachor et al. 2022), thus affecting one of the fundamental principles of the SDG that is" Leave No One Behind".(O'Sullivan et al. 2021)[7]. These same assertions have been made in the digital twin concept literature(AlAmir 2022; Bauer, Stevens, and Hazeleger 2021; Hassani, Huang, and MacFeely 2022; JRC 2022; Tzachor et al. 2022)

The use of technology to promote sustainability has received names such as "digital sustainability[8]"(Pan et al. 2022)Correani et al. 2020; George, Ryan K Merrill, and Schillebeeckx 2021; Guandalini 2022; Konys 2020; Mantovani Ribeiro et al. 2021; Sacco et al. 2021), defined by George, Merrill, and Schillebeeckx (2021) as *"the organizational activities that seek to advance the sustainable development goals through creative deployment of technologies that create, use, transmit, or source electronic data"*.Digital sustainability unifies sustainability and digital transformation to promote positive societal and environmental change(Guandalini 2022).

Digital transformation through e-government provides opportunities to improve the quality of public institutions, which is a key ingredient for implementing and realizing sustainable development. (UN 2018; UNDESA 2017)

Based on this background, the logical question one would ask is, how are SAIs reacting

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[6] See; Sahoo, A.K., Behera, H.C. & Behura, A.K. Philosophy of sustainable development: understanding public health. Environ Dev Sustain 24, 12248–12262 (2022). https://doi.org/10.1007/s10668-021-01945-5

[7] The twin transition could reinforce each other, for example in the case of "distributed ledger technology, which underlies blockchain and thus cryptocurrencies, can be used in material tracing, aiding the circular economy by better maintenance and recycling." However, sometimes the two transitions can also clash,for example the , the proof of work(PoW) algorithm in blockchain requires requires a repeatitive process to valid a transaction thus leading to huge energy consumption(see Sedlmeir et al. 2020), this in a long run may lead to carbon dioxide(CO_2) emissions.

[8] According to the The University of New South Wales Sydney's Digital Sustainability Knowledge Hub (DS Hub) "Digital sustainability (DS) is the ability to advance the UN Sustainability Development Goals (UN SDGs) through the effective deployment of digitally enabled solutions." https://www.dsknowledgehub.com/

to these megatrends that are drastically changing their environment?

As argued by previous researchers, mega environmental trends may have disruptive impacts on the auditing profession. For example, Watts and Zimmerman (1983) argued that the growth in size, number, and complexities of auditees ushered in audit sampling as an effective and efficient technique to handle these changes(Loebbecke and Neter 1975; Monteverde 1955; Tsamenyi, Cullen, and González 2006). Other trends such as the financial crisis(see ACCA 2014; Kend and Basioudis 2018), New Public Management (NPM), and New Public Governance(NPG)(see Mattei, Grossi, and Guthrie 2021; Pollitt 2003), austerity(Bracci et al. 2015) just to name but a few, have been found to affect the society including the audit profession.

Borrowing from the accounting change literature, Gilling (1976), in his contingency model of accounting change argues that changes in the environment influence accounting change, that is it serves as an isomorphic force exerting change pressures on the profession, eventually, the profession will respond gradually to its environment or in a worst-case scenario mandatorily transformed to suit the demands of its environment.

This same contingency theory view has been expressed by both public sector audit practitioners(Amimi 2020)[9] concerning contemporary changes and or innovations happening around SAIs and by contemporary auditing researchers(Canning, Gendron, and O'Dwyer 2018)[10]

The call to use modern technological tools and techniques in auditing SDGs and to digitally transform SAIs has been made by the INTOSAI[11] on several occasions, for

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[9] "Technology is driving change in society, and different professions are rediscovering roles and aligning themselves with the technological direction of the future. The auditing profession cannot be immune to these effects. With fast-paced and disruptive advancement in science and technology, it is imperative the auditing professing keep pace, particularly if we, as Supreme Audit Institutions (SAIs), are to remain relevant."(Amimi 2020) http://intosaijournal.org/the-future-of-public-sector-auditing-living-in-times-of-change/

[10]They warned that want dad changes around the audit profession should not be ignored or resisted since those changes do have a potential to disrupt the profession.

[11] International Organisation of Supreme Audit Institutions(INTOSAI). The International Organization of Supreme Audit Institutions (INTOSAI) operates as an umbrella organization for the external government audit community. It is a non-governmental organization with special consultative status with the Economic and Social Council (ECOSOC) of the United Nations. https://www.intosai.org/

example, at the 2019 XXIII INCOSAI[12], and the 24th UN/INTOSAI Symposium[13] where the themes of both events were focused on discussing the impact of SDGs and Digital transformation on the public sector audit profession.

Also, the importance of digital tools in SDG audits was explained and illustrated in appendix 4(titled: "Using data analytics for audits of the implementation of SDGs"), of the IDI's SDG Audit Model(ISAM)(IDI 2020), a guide which serves as a defacto SDG implementation audits standard.

These innovations have also led to the INTOSAI creating three working groups that is, the Working Group on Big Data (WGBD)[14] and the Working Group on Impact of Science and Technology on Auditing (WGISTA)[15] both focusing on technological advancements and disruption while the Working Group on SDGs and Key Sustainable Development Indicators (WGSDG KSDI)[16] focuses on SDGs.

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[12] International Congress of Supreme Audit Institutions (INCOSAI), it is the supreme organ of the INTOSAI." INCOSAI meets every three years and is composed of all members. INCOSAI offers all INTOSAI members an opportunity to share experiences, discuss issues, and pass resolutions and recommendations to improve government accountability worldwide." Participants of the XXIII INCOSAI (Held in Moscow from the 23-27 of September 2019,) included delegations of member SAIs as well as representatives of the United Nations, the World Bank and other international and professional organizations. Themes of the Plenary Sessions were: Theme I «Information technologies for the development of public administration» and Theme II «The role of the Supreme Audit Institutions in the achievement of national priorities and goals» (Russia, Italy) , also there was a separate Discussion Panel with participation of external experts that is PANEL 2 : Sustainable development in the age of Great Disruption: what solutions can technology and public management tools provide the governments with. https://www.intosai.org/fileadmin/downloads/about_us/Organs/Congresses/2019_Moscow_OutC_Rep/ EN_23_Moscow_OutcomeReport.pdf

[13] The UN/INTOSAI symposia provide capacity building for SAIs (Goal 2 of the INTOSAI Strategic Plan). Through the exchange of subject-specific experiences and information in all relevant fields of public sector auditing the UN/INTOSAI symposia contribute to research and methodology development in these areas. https://www.intosai.org/news-centre/un/intosai-symposia . 24th UN/INTOSAI Symposium on the theme : "Digitalization, open data and data mining: relevance and implications for SAIs' audit work and for enhancing their contributions to the follow-up and review of the SDGs"

[14] "In December 2016, the 68th Meeting of the INTOSAI Governing Board adopted the motion submitted by the Knowledge Sharing Committee (KSC) to establish a Working Group on Big Data (WGBD), which was then endorsed by the 22nd INCOSAI. The National Audit Office of China (CNAO) was designated as WGBD Chair and the U.S. Government Accountability Office (GAO) as the vice chair. WGBD was established within Goal 3 - Knowledge Sharing." https://www.audit.gov.cn/WGBD/n1525/c98665/content.html

[15] "The Working Group on Impacts of Science and Technology on Auditing (WGISTA) was officially formed at the 2019 Congress. Chaired by the State Audit Institution of the United Arab Emirates (UAE) with the US Government Accountability Office (GAO) acting as vice chair, the WGISTA will focus on key trends in areas, such as artificial intelligence, blockchain technology, cybersecurity, data analytics, 5G cellular network technology, machine learning, and quantum computing. WGISTA's primary strategic objectives include conducting environmental scanning; sharing best practices; maintaining expertise within SAIs; applying science and technology in auditing; and developing competencies required by SAIs and auditors" **https://wgista.saiuae.gov.ae/en**

[16] "The INTOSAI Working Group on SDGs and Key Sustainable Development Indicators (WGSDGKSDI) was created by the recommendation of the XXIII INTOSAI Congress held in Moscow

In summary, the public sector auditing community has realized the possible impact of SDGs and technological advancements on the profession, thus various efforts and strategies are being devised to better equip SAIs to meet the challenges brought by these innovations.

Based on this, this thesis seeks to investigate the impact of these innovations and how SAIs are reacting

2. *A Brief Review on Innovation and technology*

Organizations innovate to adapt to environmental changes to maintain and improve their performance. The adaptation process usually takes the form of exploitation and or exploration(Holland 1992; Schumpeter 1934), they have been postulated as types of technological innovation[17] strategy (He and Wong 2004; Jansen, Van Den Bosch, and Volberda 2006). For example, during the NPM "bandwagon" period, public sector organizations employed exploratory and exploitative innovation strategies by adopting and or incorporating new practices and technologies into their strategies, structures, and services to comply with functional and political pressures and or isomorphic pressures from the environment (Ashworth, Boyne, and Delbridge 2009).

Antecedents of innovation such as the adoption of SDGs,DT, do not automatically translate to innovation or change in the public sector, they require an enabler such as technology, methodology, technique, policy, strategy, etc. to bring to life the needed or anticipated innovation.

Damanpour (1991), in line with prior studies(Daft 1978; Damanpour and Evan 1984; Zaltman, Duncan, and Holbek 1973), defined innovation as "*the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization*"

While acknowledging the existence of numerous types of innovations in the innovation research literature(for example see, Downs and Mohr 1976; Zaltman et al. 1973), Damanpour (1991) proposed three pairs of types of innovation salient in the literature, that is: 1)administrative and technological innovations[18](See, Baldridge and Burnham 1975; BIRKINSHAW, HAMEL, and MOL 2008; Cardinal 2001; Damanpour and Evan 1984; Hage 1999; Kimberly and Evanisko 1981; Rowe and Boise 1974), 2)product and process innovations (see Bertschek 1995; Bhoovaraghavan, Vasudevan, and Chandran

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in September, 2019 to support the efforts of the INTOSAI community in achieving SDGs**"** **https://ach.gov.ru/en/page/the-intosai-working-group-on-sdgs-and-key-sustainable-development-indicators**

[17]Damanpour and Gopalakrishnan (2001),defined innovation as "the adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization."
Also Knight (1967) "An innovation is the adoption of a change which is new to an organization and to the relevant
environment"

[18] Sometimes referred to as managerial or organizational innovation, while technological innovation is also referred to as technical innovation.

1996; Fritsch and Meschede 2001)and 3)radical and incremental innovations respectively(see Banbury and Mitchell 1995; Dewar and Dutton 1986; Hoonsopon and Ruenrom 2012; Norman and Verganti 2014).

Prior researchers have argued for the importance of understanding the different types of innovations as a necessity for understanding an organization's adoption behavior and for the identification of factors that led to the innovations themselves(Downs and Mohr 1976; Knight 1967; Rowe and Boise 1974). This view is supported by the differences in their characteristics and differences in factors that affect the various types of innovations and even processes of their generation, and adoption is not identically the same. (Abernathy and Utterback. 1978; Daft 1978; Jansen et al. 2006; Kimberly and Evanisko 1981)

The first two pairs were re-taxonomized by Meeus and Edquist (2006) into two broad categories, that is, product innovation was subdivided into good and service innovation and process innovation with subcategories of technological and administrative innovations (see figure 1).

Figure 1: Taxonomy of innovations
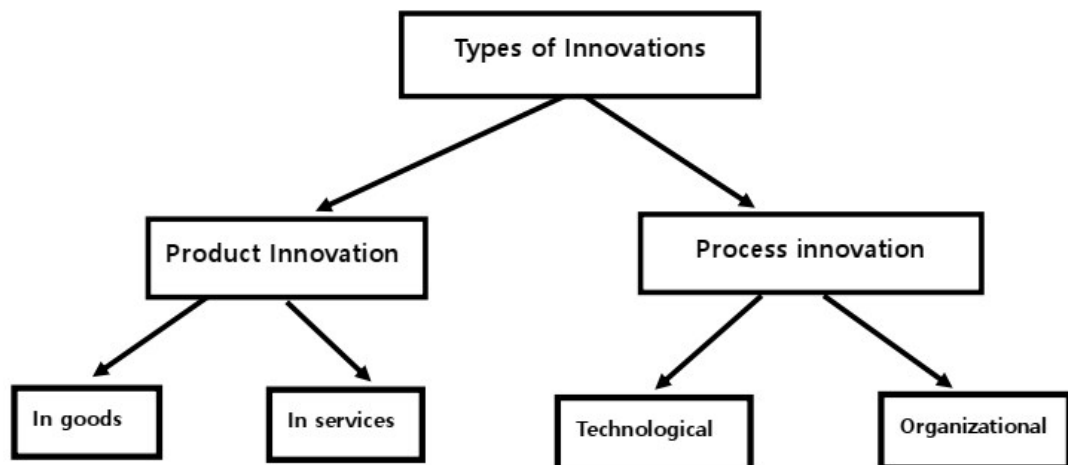
Source:(Meeus and Edquist 2006)

Product and process innovations are often related(Lim, Garnsey, and Gregory 2006; Reichstein and Salter 2006), Researchers have argued that product innovation paves the way for process innovation and vice versa, meaning that product innovation necessitates process innovation (Damanpour and Gopalakrishnan 2001; Kraft 1990) and vice versa product innovation necessitates process innovation(Novotny and Laestadius 2014).

A group of researchers argued that,though process and product innovations may be related, they are fundamentally different in terms of their goals, strategies, and the skills required for their realization. In other words, their predictor variables are not the same (Aiken, Bacharach, and French 1980; Bunduchi and Smart 2010; Kimberly and Evanisko 1981; Lager and Storm 2013; Moch and Morse 1977)

Process innovation as shown in Figure 1, can be envisaged in two forms, that is:-

administrative process innovation which is sometimes called organizational(Rowe and Boise 1974) or managerial(BIRKINSHAW et al. 2008) innovation, and technological innovations(Meeus and Edquist 2006).

Damanpour (1991), posits that implementing process and product innovations may demand distinct decision-making processes. Nonetheless, when combined, they offer a relatively comprehensive innovation because they impact various organizational activities. This perspective is supported by Evan Evan (1966) who argued in his paper on "organizational lag [19]" that their amalgamation represents the socio-technical structure of an organization.

Product innovation: A product here refers to (Barras 1986), goods or service[20] offered by an entity to its clientele. On a general level innovation research places less emphasis on the differences between goods and services, for example, services and offerings of supreme audit institutions such as performance, financial, compliance, and SDG audits are loosely considered as their products, because the emphasis here is on what is produced which may be in material goods or intangible services depending on the organization(Miles 2010; Sirilli and Evangelista 1998).

Although sometimes referred to by researchers as technological innovation, technical innovation is not simply innovation derived from using new technology.(Damanpour and Evan 1984).As described by Damanpour and Evan (1984), described it as "innovations that occur in the technical system of an organization and are directly related to the primary work activity of the organization". It can be attained through the implementation of a new idea for a product or a new service or generally an introduction of new elements in an entity's production process of goods and services(Damanpour 1991a; Knight 1967). Based on Meeus and Edquist (2006) taxonomization[21] of product and process innovation, it can be called technological process innovation, that is the introduction of a new element in the production system in the case of a manufacturing organization or service operation in the case of a service delivery organization(Abernathy and Utterback. 1978). This type of innovation is usually motivated by efficiency and effective logic in production(Boer and During 2001). Although we acknowledged that technological innovation can be in other forms, in service organizations like SAIs, it is usually linked to information technology(Barras 1990; Uchupalanan 2000)

Recently, auditors can automate the auditing process using modern technological [22] tools such as data mining(see Balkaran 2017; Kleboth et al. 2022; Ngai et al. 2011), big data analytics(Ballou, Grenier, and Reffett 2020; Bierstaker, Burnaby, and Thibodeau

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[19] "…Both types of lag are subsumed in the **definition of the concept of organizational lag** - *a discrepancy in the rate at which new technical and administrative ideas are implemented in an organization."*(Evan 1966)

[20] For more details on service innovation see (Miles 2010)

[21] See Figure 1.

[22] Researchers have called them disruptive innovation or technologies (see Cong, Du, and Vasarhelyi 2018)

2001; Brown-Liburd, Issa, and Lombardi 2015; Cao, Chychyla, and Stewart 2015; Dowling, Leech, and Moroney 2008; Ruhnke 2022; Salijeni, Samsonova-Taddei, and Turley 2021), process mining(see Jans, Alles, and Vasarhelyi 2013, 2014; Jans and Eulerich 2022; Werner, Wiese, and Maas 2021), robotic process automation(RPA), (Eulerich et al. 2021; Kokina and Blanchette 2019; Moffitt, Rozario, and Vasarhelyi 2018; PwC 2018), Artificial Intelligence(AI)(Almufadda and Almezeini 2022; Bakarich and O'brien 2021; Holmes and Douglass 2022; Ng 2022), to audit and uncover inefficiencies in a client's operational process.

The other type of process innovation (see figure 1), that is, administrative process innovation, is any incremental or radical innovation geared toward changing an organization's structure or administrative process. They are largely associated with the basic work activity of the organization and are directly connected to management(Kimberly and Evanisko 1981). In Supreme Audit Institutions, this could involve the creation of new departments such as IT, SDG Audit, Data Science, and Data Analytics departments respectively.[23]The rearrangement of the hierarchical structure, and change in personnel-related policies, for example, recruitment, reward, telework or commuting, and remuneration-related policies are all examples of administrative innovation(Evan 1966).

Administrative innovation takes place in the social system of an organization that is those rules, roles, procedures, and structures guiding the relationship and communication among people and between them and their environment to attain a common goal or task(Cummings and Srivastva 1977; Damanpour 1991b)

3. Antecedents of public sector audit innovation

Innovation in the public sector audit environment is largely influenced by its external environment, this assertion is supported by the new institutionalism postulation that environmental pressure greatly influences the adoption of innovation(Meyer and Rowan 1977), this argument is supported by the logic that, for organizations to survive and remain relevant they must conform to the pressures emanating from their environment, in this way they can gain legitimacy and guarantee their continuity.

This study identifies two main factors affecting the current public sector auditing environment, that is the (1) adoption of sustainable development goals (SDGs) and (2) technological advancement or breakthroughs popularly known as digital transformation, for the sake of simplicity, this study uses the "non-technological" and "technological" antecedents respectively. These innovation antecedents were selected based on their significant influence on innovation in the public audit environment (Huy and Phuc 2023). They have resulted in complex government systems that require advanced technologies to automate audit processes[24](Waldron 2002)

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[23]Some SAIs have   created innovation labs, which serves as incubators to experiment and develop new technological solutions to better their operations and audits.(see Otia and Bracci 2022)

[24] This was the case pre-SDGs as posited by Waldron (2002): "Increased complexities of government

The adoption and implementation or realization of Agenda 2030 goals (UNGA 2015), requires organizations both in the public and private sectors to find innovative and new solutions (Sachs et al. 2019), this need for innovation is emphasized by one of the goals, that is Goal 9 "build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation".

Technological antecedent(s)

Digital transformation or digital technological breakthrough is drastically changing the way public sector and government operates and or deliver services to its citizens(Benjamin and Potts 2018; Danielsen, Flak, and Sæbø 2022; Kitsios, Kamariotou, and Mavromatis 2023; Luna-Reyes and Gil-Garcia 2014; Mergel et al. 2018; Panagiotopoulos, Klievink, and Cordella 2019).This has also translated to a transformation in the way auditors work and even their required skillsets are changing(Suffield 2020; Vasarhelyi, Cho, and Arion Cheong 2020), SAIs are not only adopting new technologies but have started transforming their whole organization, some have created new departments such as innovation labs charged with promoting the integration of digital tools and techniques into their work(ECA 2020; Lindström 2020; Marzooqi 2022; Meijers and Moonen 2020; Otia and Bracci 2022a).

Non-technological antecedent

Antecedents under this category are in the form of reforms and other non-digital innovations in the public sector, that is innovations in public service delivery , public management techniques or public sector management philosophies such as was the case of the new public management (NPM) and new public governance(NPG)(see Mattei, Grossi, and Guthrie n.d.; Pollitt 2003) or other reforms(see Pearson 2014) such as austerity-led policies(Bracci et al. 2015).Extant literature also alludes that Innovation in auditing is also usually caused by exogenous shocks such as world wars(Perry 1944; Richardson 2006), financial and economic crisis(Abuharb 2017; ACCA 2011, 2014; Burnett 2021; Kend and Basioudis 2018; Sanoran 2018; Sikka 2009) and more recently the coronavirus pandemic(Burnett 2021; Dubrow 2020; Lepkowska 2021; El-Chami 2020; El-Chami and David Goldsworthy 2020; WBG 2020), and the adoption of SDG or agenda 2030(UNGA 2015) .

These innovation antecedents that is SDG adoption and digital transformation, converge to provide better government services. They both influence public sector innovation subtypes such as service innovation, service delivery innovation, organizational innovation, conceptual innovation, policy innovation, systemic innovation(see Windrum 2008), governance innovation, rhetorical innovation, administrative process innovation, and communication innovation(see Hartley 2005)

They both influence each other, that is governments use digital solutions to implement, govern and monitor SDG policies and projects and vice versa these digital solutions are designed with an SDG orientation. This "Innovation synergy" between the two has

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activities, coupled with the growth and expansion of advanced computer systems, necessitated the introduction of a more efficient and economical manner of conducting audits."

greatly enabled the implementation of SDG and promoted a better and transparent public sector(Camodeca and Almici 2021; ElMassah and Mohieldin 2020; Holzinger et al. 2021; Janowski 2016; Mondejar et al. 2021; O'Sullivan et al. 2021; Vinuesa et al. 2020; WEF 2022).

Summarily, these antecedents of public sector innovation are also impacting the public sector auditing profession(Radaell, Dell'Acqua, and Taffoni 2021; Scholtes, Zee, and Westerhoud 2021).This assertion follows the logic that SAIs work depends on or is guided by the activities of its auditees, that is they perform their audits on government activities, thus an SDG and or a Digital transformation oriented change in the public sector would require a similar transformation in the SAI community.

SAIs are responding by adopting and creating new audit technologies, for example concerning digital transformation SAIs are experimenting and applying digital solutions such as AI, machine learning, big data analytics, and process mining just to name a few(Amimi 2020; Dotel 2020; GAO 2021; Jan Roar Beckstrom 2021; Marzooqi 2022; Schoten 2016; Sooyeon, Taeick, and Choongjae 2021; Tritto 2020), some SAIs are creating new departments charged with technology integration(Ariga and Beisecker 2021; Beckstrom 2020; Motta 2021; Otia and Bracci 2022a).

In addressing SDG's challenges and complexities, SAIs have created a new audit technology called "SDG audits". This new audit technology combines the principles of SDG and methodologies of performance audits(Bennett 2021; IDI 2020; IDI, UN, and KSC 2019; INTOSAI/IDI 2019; Sari et al. 2022).

Previously we posited that, for innovation to take place it needs enablers such as technologies, methodologies, techniques, strategies, etc. Previously, we posited that for innovation to take place, it requires enablers such as technologies, methodologies, techniques, strategies, etc. In line with this assertion, let us explore the meaning of technology in this study, or what we refer to as technology.

In this research, the definition of technology is guided by the definition commonly used by organizational science researchers, who considers technology to be the process of converting inputs to output(Billings, Klimoski, and Breaugh 1977; Fry and Slocum 1982; Perrow 1967; Reimann 1977; Rousseau 1977). The acceptability of this definition is backed by the fact that it takes into consideration both the open system view (see Katz and Kahn 1978)and engineering view (see Woodward 1958; Zuboff 1988)of technology, in other words, this definition is not only focused on the hardware view of technology but it applies a more sociotechnical view thereby including" the generic task, techniques, and knowledge utilized when humans engage in any productive activity"(see Eveland 1986; Orlikowski 1992; Perrow 1967)

This dissertation acknowledges the fact that when we talk of audit technology, audit

practitioners(KPMG[25], Grant Thorton[26], EY[27], Deloitte[28], PWC[29]) and some researchers (e.g. Rosli, Yeow, and Eu-Gene 2013) automatically imply the use of digital technology. This school of thought equates audit technology to computer-assisted auditing techniques and tools (CAATTs). However, in this research audit technology simply means tools and techniques used in auditing, for example, ACL[30] is an audit technology likewise performance audit is, this assertion is in line with the definition that :- technology transforms an input into output(Fry and Slocum 1982; Kinney 1986).

McAllister (1993), simplified audit technologies to be of two types, he refers to as, type 1 and type 2. Based on this categorization, Type 1 audit technologies refer to those technologies that automate existing or established audit procedures, for instance, using data mining algorithms in substantive testing (Huang et al. 2022) or using text mining in auditing (Scholtes 2020). The type 1 perspective is more prevalent in contemporary audit and accounting literature, as evidenced by several studies (see Earley 2015; Eulerich et al. 2022; Han et al. 2023; Kogan, Mayhew, and Vasarhelyi 2019; Lee et al. 2022; Papík and Papíková 2022; Vasarhelyi et al. 2020; Werner, Wiese, and Maas 2021) This view overshadows other interpretations of audit technology, implying that it refers exclusively to digital technology used in audits.

Type 2 technologies on the other hand are "technologies that introduce new approaches, techniques or methodologies to auditing". For instance, the creation of SDG audits as a new performance audit technique or approach to audit SDG(IDI 2020).This emphasis on audit techniques and approaches or method as audit technology was common in the past(Cushing and Loebbecke 1983; Dirsmith and Haskins 1991; Kinney 1986)

Innovation in public sector auditing

Previously we saw that innovation in general is usually induced by external pressure or changes happening in the external environment of an entity. In addition, Watts and Zimmerman (1983), argued that a few decades ago changes in the audit market, that is, the increase in the number, size, and complexities of auditees influenced the growth and or innovation of the auditing profession, these external factors affected auditing practices greatly leading to increase the use of audit sampling technique to cope with the size and complexity of auditees. Proponents of audit sampling have argued that, it reduces costs by reducing the number of substantive tests to be performed in the case of a large firm with a large information pool as potential audit evidence.

In contemporary times the profession has seen the adoption of blockchain-related technologies in auditing to tackle the high risks environment of clients using blockchain systems (Dyball and Seethamraju 2021).

The application of big data technologies to audit big data, this new approach is generally called big data audits (Salijeni, Samsonova-Taddei, and Turley 2019), it entails a plethora of techniques and tools which are transforming the way auditors gather and analyze audit evidence(Brown-Liburd et al. 2015; Cao et al. 2015).Feliciano and Quick (2022) called these plethora of technologies "innovative information technology", others have referred to them as "disruptive" innovation(Cong, Du, and Vasarhelyi 2018).

For example, a few years ago the highly influential statistical technique of audit sampling(see Scott 1949; Trueblood and Cooper 1955; Trueblood and Monteverde 1954; Warriner 1951) is becoming a thing of the past.Today these tools have made it possible to test 100% of the items in a population of interest. (Chen, Wu, and Yan 2022; Huang et al. 2022; Murphy and Tysiac 2015)

Summarily, this thesis explores the two categories of audit technologies, namely, digital transformation-related technologies such as data mining and analytics and SDG audit technology, as enablers of public sector innovation.They are capable of handling the demands and challenges brought by the antecedents of public sector innovation, in our case SDG and digital transformation.

These innovations converge in SAIs work, for instance in auditing SDGs implementation, auditors combined SDG principles and digital solutions such as data mining to perform SDG audits. This approach is highly recommended(INTOSAI Journal 2019; XXIII INCOSAI 2019) and supported, due to the complexity of SDG implementation, which involves numerous interconnections between goals and targets. This complexity widens the scope of the audit in terms of the required audit evidence and the stakeholders who must be consulted(INCOSAI 2019b).

4. Summary of essays

This dissertation contains three essays investigating public sector audit innovation. As shown in figure two, the essays are divided into two groups based on the two innovations considered in this work, that is, Digital innovation and SDG adoption in the public sector.

The first essay (see figure 2) focuses on DT examines how SAIs approach and interpret

DT .it investigated DT from a SAIs perspective. Since it's a novel topic in public sector auditing, a qualitative research method was adopted, this method was supported with expert interviews and archival and or document data. Key findings show that the definition of DT varies from SAI to SAI, and this variation resulted from the differences in the level of digital development in each country. SAIs applied reactive and proactive change strategies. In some cases, they applied both. In a reactive strategy, SAIs reacts to change while in a proactive strategy, they experiment with technologies in advance. Most of the SAIs applying a proactive change strategy usually operated an innovation lab or an experimentation space(see Bojovic, Sabatier, and Coblence 2020; Bucher and Langley 2016; Cartel, Boxenbaum, and Aggeri 2019; Wulf 2000). The research significantly impacts the public sector auditing profession as it addresses the common misconception among SAIs of equating digitization or the use of digital technologies to Digital Transformation31. It reinforces the holistic nature of DT by highlighting the risks involved when DT is solely tied to a technology adoption strategy while ignoring other aspects, such as people, organizational structure, process, culture, and so on, that also require transformation.
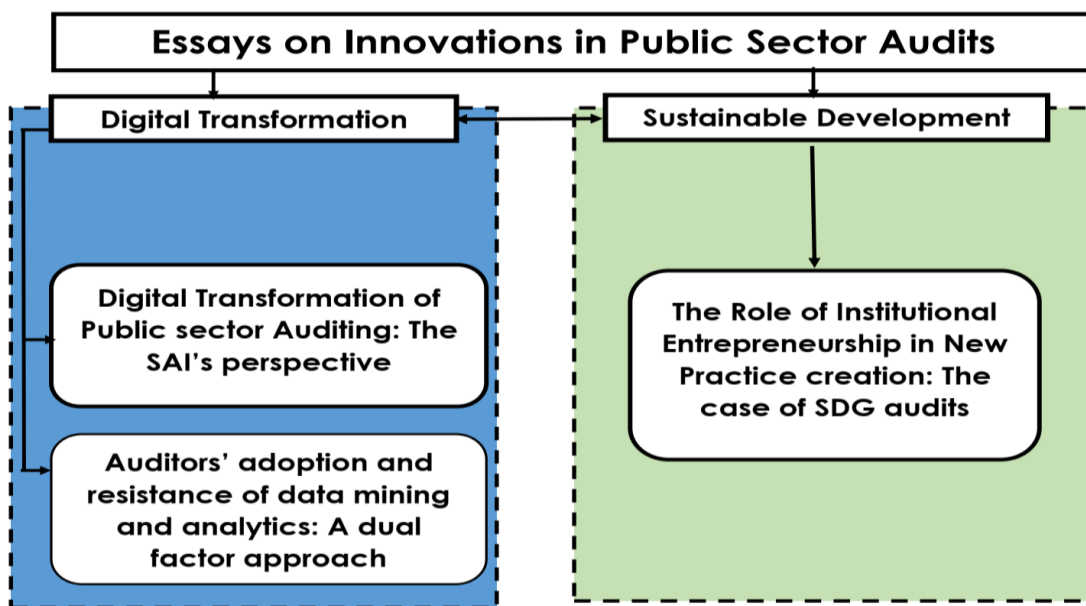
Fig.1: Summary of the Dissertation

The second essay (see figure 2) examines a sub-item of DT, that is, technology. This essay focused on the adoption of Data mining and analytics tools and Techniques (DMATTs).Motivated by the low adoption rate of these groups of technologies despite their sophisticated nature capable of assisting auditors audit in challenging environments such as public sector Big data bases(Al-Sai and Abualigah 2017; Archenaa and Anita 2015; Löfgren and Webster 2020; Long et al. 2021; Munné 2016). Applying the dual-factor theory that investigates the enablers and inhibitors of technology adoption decisions (Cenfetelli 2004; Tsai et al. 2019), this essay investigated the factors that might enable or inhibit SAIs from adopting DMATTs. The objectives and research questions warranted a quantitative research methodology,

Survey data was collected from 206 public sector auditors from SAI organizations with a history of DMATTs use or experience which was easily verified through their publicly available audit reports under the audit approach section. The collected data was analyzed using the PLS-SEM (Hair et al. 2012) and produced the following findings: a) Technology-specific anxiety (in this case DMATTs specific anxieties) was more powerful than general computer anxiety in predicting adopters' behavioral intentions towards a specific technology. They directly increase resistance while negatively affecting intention to adopt. Thus, we posited that the construct of technology or computer anxiety should be crafted based on the nature and characteristics of the technology under investigation. b) DMATTs anxieties negatively affect enabling factors such as ease of use and usefulness perceptions thus, leading to the development of a negative attitude towards DMATTs and lessening the possibility to adopt DMATTs. The research was concluded with practical implications and recommendations on reducing anxiety and enabling the adoption of DMATTs.

The third and final essay(see figure 2), focused on investigating a new audit technology called "SDG audits" (Le Blanc and Montero 2020; IDI [31] 2020; INTOSAI/IDI 2019). In this essay, the focus was on investigating the creation and institutionalization of this new practice,. The research explores SDG audit, then proceeded to examining its creation. Here the research investigated actors involved in the creation and what strategy they applied in institutionalizing the new practice. The novelty of this topic motivated the adoption of a qualitative approach using institutional theories such as institutional entrepreneurship and institutional work as theoretical lens. Basing the research on archival and interview data. It was envisaged that, SDG audit, is a hybrid performance audit created by combining performance audits logics and SDG logic (see IDI 2020), and was created through a collective effort to maintain the relevance of performance audits, that is it augments performance audits, to suit the complexities(Marra 2021) and challenges in auditing the implementation of SDGs(Le Blanc and Montero 2020).

5. **Conclusion**

In conclusion, the three essays provide an empirical insight as to how SAIs are reacting to digital innovation and SDG adoption. The essays were in two groups, the first two essays on Digital transformation and the last essay on SDGs. Summarily, essay one explores Digital transformation, by looking at what it is, how SAI react to disruptive digital changes, and how they interpret digital transformation. This inquiry was narrowed down in essay two (2), where factors affecting the adoption of data mining and analytics tools and techniques were investigated. The choice of this technology was motivated by the low rate of adoption amongst SAIs despite it being sophisticated and capable of greatly improving the quality of SAIs work.

While essays one and two focused on digital transformation essay three shifted the focus to investigating the creation of a new "audit technology"(see Fischer 1996; Robson et al. 2007; Williamst and Dirsmith 1988), called SDG audits, this new practice

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[31] https://www.idi.no/work-streams/relevant-sais/auditing-sdgs

resulted from SAIs reaction to the adoption of Agenda 2030(UNGA 2015).

The rest of the dissertation is in the following chronological order: chapter two, contains the first essay on digital transformation, chapter 3 presents the second essay on data mining and analytics tools and techniques adoption and finally chapter 4 contains essay three which looks at the creation and institutionalization of SDG audits.

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Chapter 2

Digital transformation and the public sector auditing: The SAI's perspective[32]

Abstract

The ongoing transformation of supreme audit institutions (SAIs) external environment is changing the demands and expectations of its stakeholders. The changing environment triggered by technological advancements, increased demand for accountability, and transparency means a change in the way auditing is done. The literature provides evidence of an ongoing technological innovation within the private sector audit. Private sector auditing research has focused mainly on technology adoption and use failing to address the umbrella concept of digital transformation (DT), some even consider processes of DT such as technology adoption and use to be DT. The public sector auditing literature is still yet to commence DT-related research. This study seeks to fill in this gap and after presenting what DT entails, we applied an exploratory approach through semi-structured interview responses, together with other documents from SAIs, to understand how SAIs currently perceive DT and what are their current reactions or actions to transform. The paper analyzes and discusses how SAIs perceive and define the DT phenomenon. The results show that most SAIs still, do not master the concept of DT, as they often refer to technology adoption or automation of auditing processes to be DT, notwithstanding a great majority acknowledges the need for DT but lacks the right strategy and resources in place. We saw a few proactive SAIs who are futuristic on the contrary a majority react to change when the need arises, especially during the audit process. The paper provides one of the first empirical investigations into the current DT of public audits. It also proposes a general framework suitable for analyzing the factors involved in the DT in SAIs.

Keywords: auditing, digital transformation, supreme audit institutions, technological adoption

1. Introduction

New Public Management (NPM) has been associated with a rise in the demand for public sector auditing (Hyndman and Lapsley, 2016; Johnsen, 2019). The global financial crisis of 2008 and its impact have emphasized the need for greater transparency in public expenditures and value for money (Lonsdale et al., 2011). Accountability demands are expanding (Glynn and Murphy, 1996), coming from the citizens, the Parliament, the media, donor organization, and the international community at large (Brignall and Modell, 2000; Kloot and Martin, 2000; Johnsen, 2019), and influences the way auditing is conducted (Justeen and Shaerbaek, 2010).

Supreme Audit Institutions (SAIs) are faced with an ever-increasing pressure and expectations from stakeholders to produce quality and impactful audits, as they are considered promoters of good governance ingredients such as transparency, accountability, and performance improvement (Cordery and Hay, 2019). This has also been triggered by parliamentary interest in audit findings (Skene, 1985, Guthrie and Parker, 1999; Skaerbaek, 2009; Hossain, 2010; Radcliffe, 1998), as well as by the societal at large requests for greater transparency (Sutherland, 2003; Kells, 2011; Morin, 2008; Tillema and Ter Bogt, 2010). SAIs' auditing activity is called to evolve to meet the contemporary demands of its society, as the amount of resources spent on auditing is far greater than what was envisaged decades ago (OECD 1996; Pollit and Bouckaert, 2000; Power, 1997). The ongoing transformation of SAIs' external environment is changing the demands and expectations of its stakeholders (Kudrin 2019; Hay, 2019; Bonsón and Bednárová, 2019).

SAI play a key role in enhancing public sector accountability and transparency (Cordery & Hay 2019; Dye and Stapenhurst 1998; Pollitt and Summa 1997; Morin 2011; Stapenhurst and Titsworth 2001). They fulfill this role through three types of audits: compliance, financial and performance audits (GAO, 1972;OECD, 2011). According to ISSAI (100) compliance auditing is performed by assessing whether activities, financial transactions and information are, in all material respects, in compliance with the authorities which govern the audited entity. Compliance audit focuses on whether a particular subject matter is in compliance with authorities identified as criteria. Financial audit focuses on determining whether an entity's financial information is presented in accordance with the applicable financial reporting and regulatory framework. Performance audit focuses on whether interventions, programs and institutions are performing in accordance with the principles of economy, efficiency and effectiveness and whether there is room for improvement. SAIs may differ in the way they operate that is their status and individual mandate but have largely been classified by previous literature into four models (Cordery & Hay, 2019), namely: Westminster model, Court model, Board or Collegial model and SAIs as a Government Department.

Regardless their institutional structure and nature of auditing performed and the type of SAIS, digitalization is recognized to be of importance for the future of auditing (Lombardi et al., 2015; Hay, 2019). These changes in the public sector challenge SAIs to assume new competencies and roles (Torres and Pina, 1999). SAIs are increasingly

incorporating and adopting new technologies, such as big data analytics, artificial intelligence, machine learning, block-chain, the most pertinent question to be answered is are these technology leveraging actions just a case by case reaction to pressure of disruptive innovations or its part of an overall strategy to transform socio-technical aspects of their organizations.

Auditing research has focused mainly on technology adoption/incorporation and use failing to address the concept of Digital Transformation (hereafter DT) as a whole (Manita et al., 2020; Warren et al., 2015; Al-Htaybat and Von Alberti Alhtaybat, 2017; Brown-Liburd et al., 2015; Vasarhelyi et al. 2015; Zhang et al., 2015; Pendharkar, 2005; Raphael, 2017). DT in the public sector is not just another technical iteration, it may represent a transformation of how the public sector auditing is organized, how decisions are made, implemented, and enforced (Bonsón and Bednárová, 2019; Schmitz and Leoni, 2019).

However, to date, the literature on how SAIs approach DT and leveraging technology during audits is limited. Much of the research on digital transformation and related concepts has focused on private sector auditing specifically focusing on investigating the impact and adoption or leveraging of emerging technologies (Zhang et al., 2015; Raphael, 2017, Krahel and Titera, 2015; Cao et al., 2015; Brown-Liburd et al., 2015; Vasarheyli et al. 2015). In the public sector, there is a dearth of DT research in auditing, while it appears as a growing theme in professional journals and or periodicals from SAI organizations of both local and supranational nature (e.g., ECA Journal, INTOSAI Journal).

Thus, ceteris paribus, this paper serves as a pioneering exploratory work looking at the core dimensions and implications of the DT phenomenon. In particular, we aim to explore how SAIs interpret and approach DT to uncover the implications for the future of public sector auditing from the experiences of auditors and experts. On a more granular level the aims and objectives were broken down into the following research questions:

RQ1: According to SAI's What is DT?

RQ2: What are SAI's experiences and how do they initiate and or react to DT related pressures?

In addressing the research aim and answering our research questions, we first look at why SAI's should adopt DT, what is DT and after presenting what DT entails, we applied an exploratory multi-methods approach by analyzing semi-structured interview responses, together with documents analysis from SAIs to understand how SAIs currently perceives DT and what are their current reactions or actions to transform public sector auditing. We found that the level of an SAI government's technological and digital advancements influences the way SAIs perceive and define the DT phenomenon. Thus, the contribution of this work lies in the fact that it provides one of the first empirical investigations into the current digital transformation of public audits. The paper also contributes by proposing a general framework suitable for analyzing the factors involved in the DT in SAIs.

The rest of this study is structured as follows: first, we present the theoretical background of our research, we then present our methodology, next we present our analysis and finally we discuss our deduced findings and conclude our study with recommendations while emphasizing our limitations.

2. Challenges and opportunities of digital transformation in SAIs

DT has the potential to change the way public sector audits are performed (INTOSAI, 2019), going beyond the still largely used manual auditing (Moffitt, Rozario, and Vasarhelyi, 2018; Cohen, Rozario, and Zhang, 2019). Technologies such as big data analytics, natural language processing, semantic document search are considered able to allow the processing of unstructured textual data resulting from activities such as public tenders, procurement, and aid packages (ECA, 2020). Adopting these and other technologies in SAIs auditing work has the potential of improving the effectiveness and efficiency of the audit, and its reliability too (Curtis and Payne 2008), particularly in critical and challenging tasks (Zhang, 2019), such as performance audits (INTOSAI ISSAI 3000-2019, IDI ISAM 2020; Funkhouser, 2011). Performance auditing traditionally pays much attention to evaluating the effectiveness of a program or a policy (English and Skærbæk, 2007). For instance, in auditing climate and environmental policies (Rika and Jacobs, 2019) or corruption (Jeppesen, 2019), auditors would be able to assess in real-time or actual changes or improvements in greenhouse emissions as a result of the government policy.

Over the years, different technological tools have been proposed by both researchers and practitioners. Appelbaum and Nehmer (2017) illustrated an audit automation framework where certain audit jobs can be handled by automated systems. A typical example is using drones for conducting inventory inspection, counting, and or observation in a large warehouse or open-air inventory (PwC, 2019). Robotics Process Automation (RPA) can be used in performing repetitive manual tasks such as reconciliations, internal control testing, and detail testing (Moffit et al., 2018; Huang and Vasarhelyi, 2019). Dai and Vasarhelyi (2017), focusing on blockchain, presented an accounting ecosystem where these technologies would assist in real-time monitoring and verification (Bonsón and Bednárová, 2019). Several scholars have also focused on ways of developing and incorporating different types of machine learning and artificial intelligence-based methods (Jans et al., 2014; Humpherys et al., 2011; Issa and Kogan, 2014; Yoon et al., 2015; Vasarhelyi et al. 2015). The new data ecosystem requires auditors to employ other non-standard metrics (for example Non-IPSAS or ISSAIs standards) to support their opinions (Cho, Vasarhelyi, and Zhang, 2020).

The INTOSAI highlights the opportunities brought by digital technologies and expressed difficulties especially in accessing, capturing, and treating complex data generated in the process of implementing government policies (INTOSAI, 2019). Many countries are experiencing a significant gap in data availability and the quantity of data remains a challenge, particularly in decentralized government systems at both local, regional and sub-national levels. Many auditors in this period of transition are yet to gain skills needed in a more automated audit workflow (Scholtes, 2020) and are cautious and conservative to embrace digital transformation (Alles, 2015; Zhang, Dai

and Vasarhelyi, 2018).

Literature in public sector auditing to date, however, has focused on individual technologies use and diffusion, rather than comprehensively addressing digital transformation. Digital transformation of public sector auditing provides promising outcomes, but like the popular saying by Doctorow "technology giveth technology taketh away". It comes with challenges that slow down the process of digitally transforming the auditing function. However, there exists very little empirical literature on how public sector audit institutions perceive and defines the phenomenon of DT in their strategy and operations (Eggers and Bellman, 2015). In the next section, the DT concept will be addressed together with a framework of analysis.

3. Digital transformation: conceptual development

The DT concept has been interchangeably, sometimes wrongly, associated with terms like digitization, digitalization. Digitization is the process of converting information or a process from analogical to digital (Maltaverne, 2017), which is the transformation from a physical artefact to a digital one, for example, the move from paper invoicing reconciliation to an electronic one. Digitalization is the process of using technologies to change business models. I-SCOOP (2016) defines digitalization as "the use of digital technology and of data (digitized and natively digital) to create revenue/transform business processes (not simply digitizing them) and create an environment for digital business, whereby digital information is at the core". In the same vein, Unruh and Kiron (2017) define DT as "the innovation of business models and processes that exploit digital opportunities".

Digitization and digitalization emphasize technology while DT is more concerned with strategy and overall business model. DT is a broader term, it involves the whole of organization change, not just a particular process(es) or project(s). DT is the move or act taken by an organization to keep up or adapt to a digital innovation emerging and diffusing in the external environment (Da Silva et al., 2013). DT is usually induced by innovations and the way people adopt or react to them. When the SAIs' ecosystem is affected by a technological-driven change, they may or may not respond to that by adapting and innovating to meet up new societal demands. DT is a holistic approach to change involving not only the technology but also other non-technological aspects such as strategy, organizational culture and leadership (Bumann and Peter, 2019; Parker, Van Alstyne, and Choudary, 2016).

Drawing from the available digital transformation literature (Bumann and Peter, 2019; Parker, Van Alstyne, and Choudary, 2016; Verhoef et al., 2021), and socio-technical theory (Leavitt, 1965; Clark, 1972; Bostrom & Heinen, 1977; Nograšek & Vintar, 2014) we derived the following DT framework (Figure 1). Socio-technical theory for example suggests that to digitally transform an organization, it must consider the different relationships between the different subsystems of an organization (Leavitt, 1965). In particular, the framework illustrates that DT requires integrated and connected moves towards a change in an organization's strategies, organization, processes, people and

culture, and technology. The five factors are directly involved with DT, but also bear reciprocal relations.
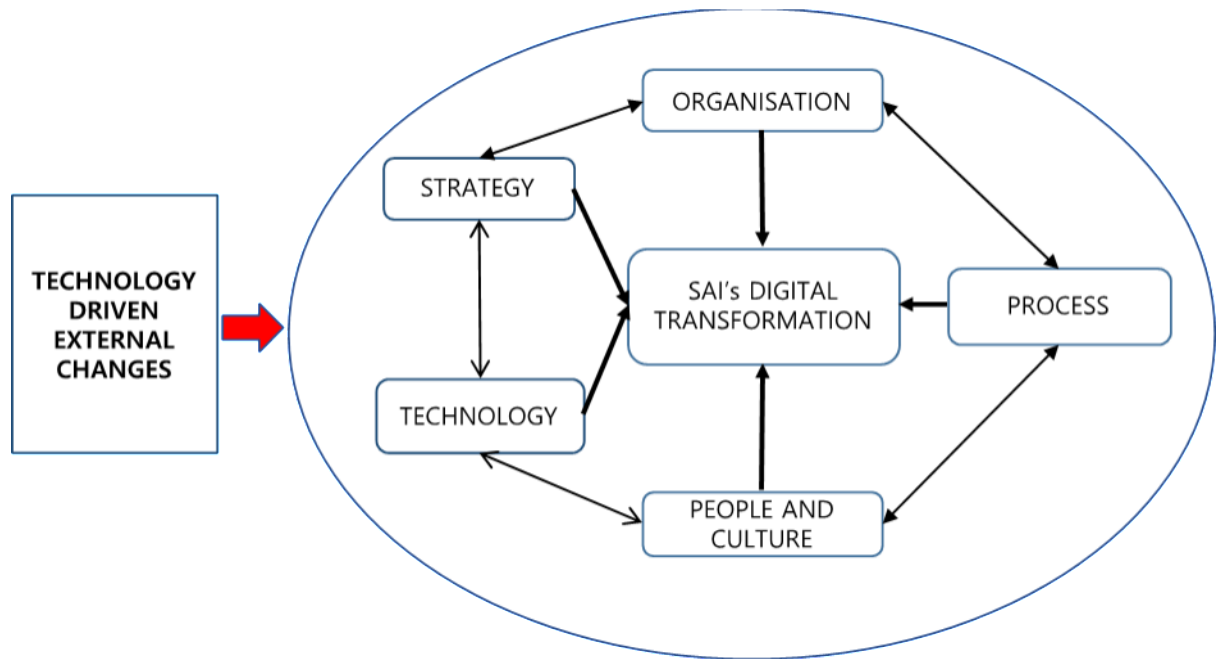
Figure 1: Digital transformation framework

The first key tenet of the framework is the existence of a DT strategy. A well-structured digital strategy is considered as an important ingredient for a successful digital transformation. There is a great debate on what digital strategy should an organization adopt, this debate can be classified into three schools of thought. The first group considers a digital strategy to be a subordinated functional-level strategy that works in line with the overall business strategy (e.g. Chan and Reich, 2007; Luffman, 1999; Sabberwal and Chan, 2001; Matt, Hess, and Benlian 2015). The second school of thought argues for a strategy that combines the IT or digital strategy and the overall organizational strategy (e.g. Bharadwaj et al., 2013). And finally, the last group considers digital transformation to be an overarching subject matter that must be handled separately (e.g. Hess et al., 2016; Ismail, Khater, and Zaki, 2017). Despite these divergences, they all agreed on the need for and importance of a strategy. Management should not only well articulate their vision and strategy but must strive to properly communicate it with the rest of the organization.

Ramilo and Bin Embi (2014) argued that DT is a disruptive process requiring new forms of organization, thus DT is a holistic approach to change where the interdependence of organizational technologies and structures is recognized (Liao and Ai Lin Teo, 2018). The organization element of the model refers to how the organizational structure is transformed, through new internal procedures, regulations, standards, and guidelines (Berghaus et al., 2017, Schlaepfer et al., 2017). Previous research argues, DT has a great impact on organizational structure (Sklyar et al., 2019). DT attainment requires organizational changes that matches digital changes (Eggers and Francis Park, 2018), that is creating a less stressful DT process. Agility enabling orgainsation structures such as lean, flat holarcratic (Verhoef et al., 2021) organizational structures are commonly applied by DT leaders. Agility aids their response to disruption from their ecosystem

(Gimpel et al., 2018). Organisations are called upon to "move away from traditional hierarchies and embrace leaner and flatter organizational structures which empower employees and allow greater agility and faster decision making" (WEF, 2016). Organizations usually create new roles such as Chief Digital Officer (CDO) or Chief Information Officer (CIO) to lead their organization's DT campaign (Kraus et al., 2021). The digital transformation in the organizational dimension is closely related to the other dimensions such as culture, strategy, technology.

Technologies by themselves are useless without the right competencies and skills. It is a failure for an organization to invest in technology thinking it will add value without properly considering those who are to use it (Andersson, Movin and Teigland, 2018). People here involves both the management and new roles such as CDO and CIO (Kraus et al., 2021). Leading DT does not necessarily mean neglecting the role of people or paying less time to organizational cultures and other non-technology aspects of DT. DT leaders should avoid starting the change process with technology. Firstly, they have to embed auditors with digital culture. Staff will certainly require new skills and experiences with different technologies (Andersson et al., 2018). SAI organizations should invest in empowering their employees through training programs (Schlaepter et al., 2017). DT goes beyond adopting new technologies or designing new processes and services. A digital culture determines how an organization's staff understands, accepts, and advances DT. This is very important especially in the accounting and auditing profession that works with rules and standards. Without a well-managed digital culture, that is aligning DT with employees' values, it would be like forcing technology on staff, which may resist (Craig et al., 2014). DT focused only on technology at the expense of culture is limited, as digital culture is as important as technology. Cultures such as the "fail forward culture", as described by Schlaepfer et al. (2017) that create the opportunity to experiment, encourage creativity and try-outs, should be in place. In such a culture, auditors will have the opportunity to try to experiment, and if they fail, it can be considered as part of the learning process to better their art. A successful digital culture must have good digital leadership that can create a conducive environment for innovation and is not afraid to invest in risk-taking (Berghaus et al., 2017; Kane et al., 2015).

Technology is unarguably very important in DT, but its adoption should come after the right organizational culture and strategy is in place. The agility of an organization in adapting and using new technologies is very essential for DT to take place (Hess et al., 2016). SAIs should lead by example; they should be proactive to be the early adopters and leaders. SAIs should experiment with new technologies and innovations to discover potential that can help innovate their work. Today we have technologies such as IoT, Blockchain, ML at an infancy stage in the SAI community, these are potential disruptors that SAIs should look after (Beckstrom, 2020). Ingestad (2020) posits the unprecedented scale of technological innovation. Technological changes are pervasive, persistent and extremely rapid. SAIs should improve the effectiveness and efficiency of their processes by leveraging the power of advanced technology. Techniques such as process mining could help improve their efficiency since it is designed to discern, monitor, and improve real processes, using SAIs current organizational event logs, process mining can extract knowledge on how processes currently functions and can

monitor deviations by comparing a simulated process model and the actual Log (Van der Aalst, 2016). Labour-intensive processes can be automated to gain efficiency and to give auditors enough time to focus on brainstorming activities. SAIs currently face a sophisticated audience (stakeholders), who do not only expect them to react to their demands but also in predicting their needs. SAIs should adopt a customer-centric view when transforming their processes, which is looking at the needs of their stakeholders.

The five elements of the DT framework need to be considered with a holistic approach (Bumann and Peter, 2019; Parker, Van Alstyne, and Choudary, 2016), taking into consideration not only the technological aspects but mostly the other non-technological ones and the existing interrelations.

4. Research methodology

To understand SAIs' perception of and how they approach digital transformation a qualitative exploratory research approach was adopted. Exploratory research is an appropriate way of establishing the field at the early stages of an emerging topic, particularly in studying expert practices like auditing (Power and Gendron, 2015). From an ontological and epistemological standpoint, we adopted the interpretive research paradigm (Miles et al., 2013). The core purpose of an interpretive research stance is not to "discover the truth" (Rynes and Gephert Jr., 2004) but to comprehend the meaning and concepts applied by social actors (SAIs) in their practice setting as a means to uncover the different versions of reality for each social actor. Based on this assertion, social actors (e.g SAIs) are considered to be subjective (Guba and Lincoln, 1994). Our methodological approach is appropriate as both social actors (the researcher and the auditors) are under the constant influence of social interactions which imparts the existing and changing reality by reflecting on their beliefs and values (Power et al. 2015).

4.1. Data Collection and analysis
Given the novelty nature of this phenomenon (DT) in the SAIs' community, semi-structured interviews were conducted as an instrument to collect data directly from social actors (auditors) involved in digital transformation within the SAI Community. Semi-structured interviews, being flexible by nature, were considered more apt to gather insights from the SAIs' auditors (Horton et al., 2004). We adopted a purposive homogeneous sample (SAI's common function is auditing the state), choosing such a sampling method was informed by the principal aims of the research, existing knowledge and theories available on the topic, the research gap to be exploited, and the research population. The SAIs' auditors selected were experts with technical, process, and interpretive knowledge concerning the digital transformation of public sector auditing. We were more lenient with the definition of experts since digital transformation is still a new evolving phenomenon in the SAI community. We considered experts to include leaders of SAI at all organizational levels who are championing the digital transformation crusade. Meuser and Nagel (2009) consider an expert to be one who is responsible for a concept, has relevant factual knowledge, accumulated or specific knowledge, information, or privileged access to information. Our expert's selection process lay less emphasis on their biographies (Mergel et al.,

2019) but we were more interested in their viewpoints, their role as leaders or representatives of SAI organizations, privileges they have in accessing decision making processes and people (Ines et al, 2019). The experts selected are very well known for their direct involvement in digital-related transformation activities in their SAI organizations or at the international level through INTOSAI, most of them being speakers at or a host of digital transformation-related seminars, webinars, and conferences, at their office level or internationally participating in regional organizations. We also considered their activities involving designing and setting digital transformation strategies for their organization. Our experts selected range from heads of SAIs, heads of IT units, or SAIs who are or play the role of CIO (Chief Information Officer), CDO (Chief Digital Officer), and heads of innovation Labs, and so on. The strength of an expert interview research method relies on the number of interviews carried out and the quality of the experts who participated (Mergel et al, 2019).

We applied the chain referral approach (Snowball sampling) that is asking interviewees to propose or connect us to experts who can give an insight into the phenomenon in question. We contacted 80 supreme state Audit institutions but received acceptance for an interview from 15 SAIs and succeeded in interviewing 11 SAIs as shown in table 1 below. The low and slow response to our interview request was mainly due to the novelty of the concept amongst SAI, the COVID 19 outbreak, and in some rare cases language barrier but our research compensated for this low turnout by reviewing the secondary sources of information (see appendix). To decide on the minimum level of interviews to be carried out in qualitative research is a never-ending question (O'Reilly and Parker, 2013). To adequately capture the patterns and divergence across interviewees, Glaser and Strauss (1967) proposed at least ten interviews, while Guest et al. (2006) advocated for 12 interviews as a threshold where one can obtain insight about the studied phenomenon. However, the key tenets we followed is to reach a theoretical saturation (Guest et al., 2006; O'Reilly and Parker, 2013), when no further insights were coming from new interviews. Consequently, given that from the last interviewees no additional evidence or new insights were emerging, a theoretical saturation can be claimed to be achieved.

To complement the empirics, we performed a document analysis. Documents provide data on the context within which the social actor operates (Mills, Bonner, and Francis, 2005). Document analysis assists the researcher in uncovering meaning, developing understanding, and discovering relevant insights about the phenomenon under study (Merriam, 1998). A document can also play an ex-ant role in helping the researcher design the research questions, derive a research problem, and even direct how interviews may be conducted since it can be referenced or can contextualize the data collected during interviews. We applied document analysis as a complementary research method to triangulate research findings (Brown, 2009). Applying a document analysis to this research will go a long way to help it obtain evidence triangulation-that is corroborative findings can be envisaged through the different methods of data collection and analysis employed in this research. We reviewed over 300 publications relating to DT, we excluded those published by non-SAIs such as publications from hired experts who are not supreme state auditors. This reduced the sample to 102 documents.

TABLE 1. Summary of interviewees

N	ID	Date interviewed	Role	Duration of interviews (Min.)	Region	Medium
1	001A1	22/03/2020	Head of IT	41:22	Middle East	Skype
2	001C2	21/03/2020	Auditor General	38:24	Asia	Phone
3	001F3	11/03/2020	Auditor General	35:51	Europe	Skype
4	001K4	04/04/2020	Auditor General	43:44	Africa	Skype
5	001N5	30/03/2020	Manager Datahub	26:32	Europe	Phone
6	001S6	27/03/2020	IT Audit Manager	71:24	Europe	Skype
7	001U7	18/03/2020	Deputy Head of IT Department	45:18	Asia	Skype
8	001D1	17/12/2020	Director -Data Analytics	69.05	Europe	Zoom
9	001B1	15/12/2020	Chief data Scientist	45:17	Europe	Zoom
10	001T2	09/01/2021	Chief data Scientist	39:45	Europe	Zoom
11	001N2	21/01/2021	Senior Data Scientist	75:32	Europe	Zoom

Videos as a source of evidence have been used for some time now in social science research (see Goldman et al., 2007; Erickson, 2011). Jewitt (2012) argued that video can support exploratory research allowing the capture of things that may pass unnoticed, it allows researchers to revisit past moments and reawaken the experiences of researchers and/or participants. The videos were collected from SAIs Websites, social media channels like Twitter, Facebook, and YouTube. We were careful to focus on digital transformation-related videos. We downloaded and transcribed 12 video presentations, adding up to 102 documents initially collected, our total sample increased to 114 publications spanning from 2015 to 2020.

5. Digital transformation: the SAI's perspective

The advent of new technologies in the public sector poses questions such as: what is the future for public sector auditing in this world of big data, data analytics, artificial intelligence, the internet of things, machine learning and the digital revolution? Some see these innovations as a threat while others see them as an opportunity. Unlike in the private sector, where the digital revolution in auditing was highly motivated by the auditees who demanded more from auditors as their business information systems went automated, SAIs are called upon to lead and recommend digital transformation to their auditees (INTOSAI, 2017). The limitations of actual practices, the auditors interviewed and extracts of experts from the documents argued for the need to move forward in adopting new technologies:

"How do we engage the entire community in understanding and using big data? Auditors must be involved in this movement! We must experiment! We may fail, but we have to try!" (Wesley Vaz-Silva, SAI Brazil's Secretary of Information Technologies for External Control)

At the helm of INTOSAI, there is this unanimous acknowledgement of the potential impacts these technologies will have in public sector auditing and through seminars, workshops, and conferences, calls have been made to awaken SAIs to be better prepared to adapt to this new public sector auditing environment. The XXIII INCOSAI 2019 was dedicated to discussing how SAIs on a government or domestic level could relate to the public sector auditing developments and technological evolutions to remain relevant while addressing the needs of different stakeholders and adding value by offering independent external oversight on the achievement of nationally accepted goals including those linked to the sustainable development goals. The conference was able to paint a picture of the fundamental changes in public auditing and policy globally that have created a new environment and expectations for and from SAI (INCOSAI, 2019). These changes have echoed the need for new approaches in the public sector auditing and urge SAIs to rethink their role in the governmental accountability process (INCOSAI, 2019). SAIs may be different about their capacities, constitution, and mandates but they all have some homogeneous challenges such as coping with the complexities of governments policies to achieve both national and internationally agreed goals (e.g. SDGs), also data revolution and digitization has brought great changes to SAIs work. Even the INTOSAI Supervisory Committee on Emerging Issues and SAI leaders have acknowledged the potential impacts of science and technological trends on governments and SAIs in the future as echoed below:

[...]"Technology is driving change in society, and different professions are rediscovering roles and aligning themselves with the technological direction of the future. The auditing profession cannot be immune to these effects." (Al Amimi, President, State Audit Institution of the United Arab Emirates).

The continuous generation and accumulation of data and technological advancements serve both as challenges and opportunities to ameliorate public audit quality:

"The digital age gives SAIs ample opportunities to modernize and ample opportunities to fail, but we should not be afraid." (Dr. Ellen van Schoten, Netherlands Court of Audit).

Driven by these changes in the audit eco-system, SAIs have started to experiment with the potential applications of DT in auditing. An ECA audit team applied visual data analysis (VDA) techniques to help fish out undervalued textile and shoe products from China (ECA Journal of 2020). In 2015, the audit Account chamber of the Russian Federation developed an Information Analysis System (IAS) to conduct remote audits. With the backing of the 2013 federal law that gave them the right to directly access auditee information systems, they were able to assess more than 130 information systems in more than 30 states agencies. In 2017 alone, the IAS helped the auditors in detecting 650 procedural violations (10% of all the violations identified that year) and concealments in the public procurement process. The SAI of Peru invested roughly 2.7 million USD in executing the CCM (Concurrent Control Model). Using this model,

they were able to help the state prevent loss worth 26.5 million USD relating to the 2017 "EL Niño" phenomenon construction and reconstruction work."

As the above examples show, DT in SAIs' work is diffusing with a great interest in the potential applications. The next section portrays the findings concerning the factors involved in the DT of SAIs, as guided by the framework of analysis (Figure 1).

5.1.   Strategy

The strategic approach that SAIs adopted towards the changing environment can be broadly classified into proactive and reactive change. Pathak (2010) argues that "Proactive change is a change that is initiated by an organization because it is desirable to do so. Reactive change is change initiated in an organization because it is made necessary by outside forces".

SAIs showed a proactive approach by creating in-house digital or technology incubators (innovation labs) to help fish and experiment potential (disruptive) innovations. Digital factories (Innovation Labs) require a cross-functional approach that is bringing together people from different specialities and departments with one goal to develop new value propositions or unique products. Some SAIs are already experimenting with that. The ECA in its 2018-2020 strategy aims to exploit technology to bring innovation in its audit, which is greasing the wheels for auditing and better presentation of audit findings in its reports. In particular, ECA has created the ECALab, an interdisciplinary innovation laboratory with the main focus on DT of ECA's auditing function using technological advancements (ECA, 2020), constantly testing new audit and organizational procedures refining and iterate them before finally integrate them into the broader organization (Bhapker and Dias, 2017).

In a bid to improve audit quality and make the audit work more efficient and easier in this digital era, some SAIs are taking a proactive strategic stance. Initiatives such as the creation of innovation labs (incubators) are an example. In this incubator environment, digital culture is becoming the new normal especially amongst SAIs from technologically advanced nations (e.g., SAI Belgium, Norway, GAO, Russia, UK, South Korea, ECA).

[....]"Innovation labs, also often referred to as accelerators, hubs, or incubators, are units or teams that employ creativity and flexibility aimed at inventing ideas, products, processes, and services to help solve problems, create work efficiencies, and address emerging trends. They can function in a variety of ways—operating as a completely separate unit from the organization or functioning as an internal team staffed with existing employees." (INTOSAI 2020).

For example, in 2019, the office of the Auditor General of Norway established an innovation lab to help respond to emerging science and technological trends affecting the audit community (Beckstrom, 2020). ECA created the ECALab made up of experts from different fields (IT, audits, and language services) to explore innovations, technologies, and methods. Currently, they are working on the possibility of using

association mining in performance auditing. Table 2 below shows some of does capacity-buildingSAI's proactive change initiatives through the creation of incubators of ideas or innovation Labs.

In other SAIs, a more reactive strategic response was initiated. This strategy response was mainly driven by the offerings of technological revolution and big data. These are reactions by leveraging the power of technological tools. Below is an example of reactive changes:

[.....] "In 2014, SAI-China set up the Department of Electronic Data Audit, which collects, verifies, and processes electronic data related to audit, aiming for the holistic analysis and use of such data. Since 2015, SAI-China has started Phase III of the Golden Audit Project, which focuses on big data. At present, SAI-China is trying to promote the digitized audit approach featuring "general analysis, spotting suspicious items, decentralized verification, and systemic research", and exploring the comprehensive analysis and utilization of data from multiple levels, regions, systems, sectors, and businesses. "(001C2).

Table 2. Example of proactive strategic initiatives by SAIs

SAI	Name of Innovation Lab/incubator
Federal Court of Accounts – Brazil (TCU)	coLAB-I
ECA	ECALab
Office of the Auditor General (OAG) of Norway	Innovation Lab
US Government Accountability Office	Innovation Lab
SAI Belgium	DataLab
Netherlands Court of Audit	Innovation Lab

Some SAIs also pointed their rapid transformation using new technologies was induced by the pandemic which restricting them to carry out their business as normal, as a result, they sort to virtual and remote auditing practices such as automating and connecting data query systems with their auditees, using video conferencing to carry out interviews, etc. (Reactive change)

"The COVID-19 Pandemic has forced SAIs to adopt in a short space of time a new way of interacting with each other in the workplace; to relook the concept of the physical workspace; to consider how SAIs need to respond to these very changes that are occurring in the public sector; and, to re-examine the changes that would be required to how work is executed on a daily basis. SAIs must be ready to respond to the change brought on by the new normal. This means greater use of information technology and data analytics to enable the application of real-time audit techniques" (CAROSAI 2020)

"COVID-19 is affecting us all. The way we live, work and socialize has changed dramatically. The National Audit Office is no different, our staff is working from home and we will also have an important role to play in reporting on the government's response to COVID-19."(Yvonne Gallagher 2020)

The SAIs interviewed are adopting real-time and continuous auditing models to meet up with the challenges, this implies a transformation of both how they operate and how they audit. NAO Finland applied agile and took a reactive approach to meet up with its changing environment (that is transformation on how the central government manages its finances).

"…NAO Finland extensively reformed financial audits over the past year …The reform, which responds to changes in managing central government finances, aims to use new digital technologies more extensively. NAO Finland is excellently positioned to leverage data analytics to improve financial audits given its longstanding use within the organization coupled with an extremely high level of digitalization in the financial administration of Finland's central government." (Beckstrom -NAO 2020)

Conclusively, despite being futuristic and having an innovative culture, SAIs do acknowledge their digital transformation goals to some extent can be hindered by their auditee (Government level or transformation or degree of interest in DT).

5.2.   Organization

SAIs are updating their organizational structure with the creation of special innovation or foresight departs in charge of leading digital transformation and innovation-related activities. Today's most innovative SAIs starts the DT by creating a foresight organ. Such organ usually does not focus on technology alone but starts by asking the right questions then seeks what technological tool can answer such a question "a kind of reverse engineering process" (Person. 2021), most of the incubators or innovation Labs were born by foresight organs. For example, ECA started by creating the Digital Steering Committee (DSC) which led to the creation of ECALab ("a place where auditors and data scientist can find each other and where ideas for technology and innovation can be nurtured and put into practice"(ECA 2020))

"Digital technologies are transforming the world at an unprecedented speed. With the creation

of its Digital Steering Committee (DSC), the ECA identified an urgent need to undertake a digital transformation in the way we audit. The aim of this transformation is to use the potential of technology to deliver our audits more easily, quickly, accurately and extensively than ever before and provide more useful information for the accountability process". (ECA JOURNAL 2020)

GAO through the Science, Technology Assessment and Analytics unit (a foresight organ), and established their Innovation Lab. Innovation labs as an organizational construct are also called "digital factories", a place where auditors of all departments do collaborate and share ideas, and with the aid of agility and design thinking, new products and services are developed.

".... the ECALab, an in-house centre for research and innovation. This space for sharing ideas, exploring, testing, and implementing technologies in the audit process is part of the ECA's digital transformation initiative. The ECALab is comprised of data science enthusiasts and expert auditors who cooperate on finding tailored solutions to audit tasks and audit-related projects." (Fossati, Reilly, Schnell, 2020).

This in itself creates, to a certain extent a leaner and flatter organizational structure, which empowers employees (auditors) and allows "greater agility and faster decision making" (WEF, 2016, Nadkarni and Prugl, 2019). Conclusively, the organization dimension of DT overlaps with the other dimension e.g SAIs adopting an agile culture.

Presently even at the level of INTOSAI, there exist no specific standard guiding the digital transformation of Audits. What is present are INTOSAI guides on applying specific individual technologies. For example, the IDI's SDGs audit model ISAM (pilot version March 2020), dedicated an appendix titled "Using data analytics for an audit of the implementation of SDGs". Generally, SAI at the national level does have some sought of in-house guidelines on how to integrate technological tools and techniques into the auditing process. Capacity-building seminars and workshops to discuss standard operating procedures for using these technologies have been the norm. Regional and international SAI do share best practices especially using the INTOSAI as a platform. SAI China, as an example, has proposed a draft "Guidance on Conducting Audit Activities with Data Analytics", but it has still to be approved.

SAIa using their independence and the freedom to design how they audit, create in-house procedures and guidelines on how to integrate technology into their auditing workflow where necessary. Most SAIs are adopting their Governments' public administration guidelines on digital Transformation. This is so common amongst EU SAIs, whose main source of technology and big data analytics guidelines are generated from different EU digital transformation initiatives such as the "DIGITALEUROPE", supranational agreements such as the Tallin eGovernment Declaration' (2017), and other Eurostat guidelines on big data. Nevertheless, we had one interviewee who stressed the difficulty in setting a universal or a panacea-like standard to regulate digital transformation in auditing:

"(…) We don't use regulations because that's difficult since we use many different techniques. Sometimes they're somehow experimental, so I think writing a regulation brings about a new technology. We use "R" in our office, so when we write an R script, we describe every step that was taken with the data, in that way we ensure that the replicability of the work becomes a scientific formula. We always tell our auditors to document everything in the R script and

preferably they should take a clearance procedure with the department that was audited by handing them their R script for them to see what data was used". (001N5).

5.3. Technology

Interviewees generally agreed that DT will increase audit efficiency and effectiveness. Data analytics augments analysis capacity, allowing for population-wide testing and profiling, smarter non-statistical sampling, as well as the use of automated and repeatable analytical processes. Envisaged as a useful tool in audit planning, data analytics will also focus on risk-based areas of interest and anomaly identification, resulting in more meaningful analysis and objective sampling. (INCOSAI, 2019). However, just a handful of auditors are equipped with data analytical skills and versed in data mining (Scholtes, 2020). Given the fact that a majority of data in the public sector is unstructured, without using other techniques, it will not be possible to make sense of big unstructured data, currently, and data mining tools are commonly applied in mining structured data such as spreadsheets in rows and columns formats.

Hu Zejun, Auditor General, National Audit Office of the People's Republic of China (CNAO) argues that:

"Big data auditing is a brand-new embodiment of audit work that facilitates the evolution from audit sampling to the population; audit parts to the whole; and micro to macro and provides new methods to improve audit quality and efficiency."

Technological advancement exposure amongst SAI is linked to the level of their countries' E-government level. Most SAIs due to lack of resources and motivations from their governments are reluctant to be proactive in venturing and fishing out potentials of emerging technologies, one interviewee said: "We always look at the cost and benefit of a particular technology before implementing or applying it in a particular audit" (001A1).

Therefore, the findings show that the level of E-government affects the degree to which some SAI apply technology to their audits and thus affects the way they approach digital transformation. This is true as we could attest that low-income level nations are still very behind and are practicing traditional auditing with less motivation to transform their practices (venturing into the offers of emerging technologies) along with their highly sophisticated E-government counterparts. Interviewee 001N5 states: "we can't audit using these emerging technologies when our governments themselves are still using old school methods".

Most of the interviewees acknowledged the capabilities of emerging technologies to improve or eliminate the current traditional auditing methods. Some point at specific technologies that could drastically transform public auditing, but they stuck to the point that it can't replace the auditors, one interviewee (001N2) after acknowledging the disruptive nature of the blockchain, believes it can't replace auditors' role of assurance if they change:

"The point of auditing is not to have auditors doing the same profession until the end of the world, the point is we want to have guarantees of transactions and have certified information (…) in the coming years' auditors would not be doing what they are doing now because

blockchain technologies will do that, but they will now shift their focus to emphasizing things like organizational culture and more strategic information and analysis (...) in my opinion be it blockchain or any other revolutionary technique and technology (AI, ML, NLP, RPA) they will cause the traditional auditing method to become obsolete thus auditing will change to start doing what machines cannot do". (001F3).

The majority of interviewees do acknowledge the pace has picked up and they are now at a stage where they risk becoming obsolete and irrelevant if they do not keep pace with the technological transformation, ignoring it only at their liability. Interviewee 001B1 posits:

"All of the above technologies (NLP, Big data analytics, Blockchain, in-house, and smart contracts, Machine learning, Natural language processing Process mining, RPA) are very promising and have high potential in improving audit practices. We can look at these technologies with two lenses. In the short term, we believe big data analytics and robotic process automation will be the technologies to watch out for. We would even venture to say that auditors will soon be required to use data analytics almost universally. Robotic process automation will be the next frontier. In the long term, as a future-looking auditor, I will keep close track of blockchain, smart contracts, machine learning, and Artificial Intelligence. It is worth mentioning that, though these technologies are not expected to take over the role of an auditor, they will act as enablers for more innovative and smart ways of practicing auditing. Interpretation of results and presenting information to decision-makers will remain a task of an auditor."

SAIs, especially from technologically advanced nations, are heavily investing and acquiring the latest and most sophisticated equipment and tools capable of handling the complexities of big data. Most of our respondents attest to have renovated and augmented their IT Tools:

"Our auditors are using different software, for example, we have ALC, Microsoft Power BI, strata, Macro Bond, NVivo for text analysis of interviews. We have a bunch of other smaller software packages which have been developed and designed by our staff. We have a data analyst team in charge of coding" (001F3)

More effort towards building a remote auditing environment is the next step SAIs are taking, some are already enjoying a cloud environment and are working remotely.

"Currently, SAI Belgium is investing in high-performance, centralized computers, and developing a Structured Query Language (SQL) warehouse to store recurrent financial data flows from the administration. Cloud-based solutions are also being investigated, and the organization's Data Protection Officer has established a data protection policy." (Koen Van der Bracht, Supreme Audit Institution of Belgium).

In terms of the application of technology in audits, most SAI find it more flexible to use technology in financial audits than in performance audits, this is partly due to the nature of data involved. Financial audits largely use structured data (spread sheets or tabulated data) while performance audits use any data type (i.e., both structured and unstructured data link plain text from social media etc.). Although much of the analytics applied in audits has been in the area of financial audits (Mariusz 2020), there are also cases where technology has been leveraged in performance audits. The UK NAO Central analysis teams whose goal is to investigate value

for money by applying specialist analysis techniques to government data to generate new insights' (NAO 2021). As the empirics and key cases show, in the future public sector auditor will increase focus on value-for-money audits and employ more creative and intelligent work extending "beyond the boundaries of transactional audit and account certification." (WGISTA 2020).

5.4. People and Culture

The conservative nature of the auditing profession has been a major challenge to the adoption of disruptive technologies in public sector auditing. SAI CHINA pointed out the aspect of resistance to change (traditional auditors being too conservative): "Compared to the difficulties of learning new technologies, I think it is more difficult to change people's inherent thinking patterns and build a new big data auditing culture. At present, the SAI-China is trying to promote the digitized audit approach featuring "general analysis, spotting suspicious items, decentralized verification, and systemic research", and exploring the comprehensive analysis and utilization of data from multiple levels, regions, systems, sectors, and businesses. We prove the effectiveness of big data audits through practical results and promote changes in people's inherent thinking".

At the International level, INTOSAI and different regional SAI have been carrying out DT leadership activities such as organizing Capacity Building seminars and conferences on how to leverage digital technologies in Auditing. For example, the 24th UN/INTOSAI Symposium theme was "Digitalization, open data, and data mining: relevance and implications for SAIs' audit work and for enhancing their contributions to the follow-up and review of the SDGs". In more general terms, capacity building collaborations have been and or are being organized with multidisciplinary courses and training sessions:

"We have held regular training to universalize Data Analytics skills among our auditors. Recently, we launched the SAI Academy and one of our key focus areas for capacity building is Data Analytics. In my view, there is going to be gradual progress towards Artificial Intelligence but right now we think that Data Analytics is the first step towards that goal" (001U7).

SAI organizations are exhausting all possible means by which their staff can get training, apart from in-house training, experts are usually hired to train SAI through workshops and seminars, some organizations pay for courses at universities and on online platforms. They even go as far as providing intrinsic and extrinsic motivations pushing SAIs to embrace and enjoy learning new skills. NAO UK has implemented a "Skills passport" auditors fill in this form which has checkboxes indicating to what extent an auditor is familiar with a particular technology or analytical method. Since this was instituted, NAO has experienced an increase in the number of technology experts (NAO, 2019). The interviewee raised a point concerning the diversity of Audit teams:

" (…) so there is a problem of skills, you can't just hire a programmer and put in front of the computer to perform auditing, likewise, you can't just give a performance auditor a computer to just start programming let's say with python or write a script or syntax, although there is this

expectation that an auditor should have both skills ...it's tricky, but what we have done is we have programmers who help performance auditors with data skills and performance auditors do the same to pass on their auditing skills. (001S6).

Figure 2. NAO Skills Passport for data analytics
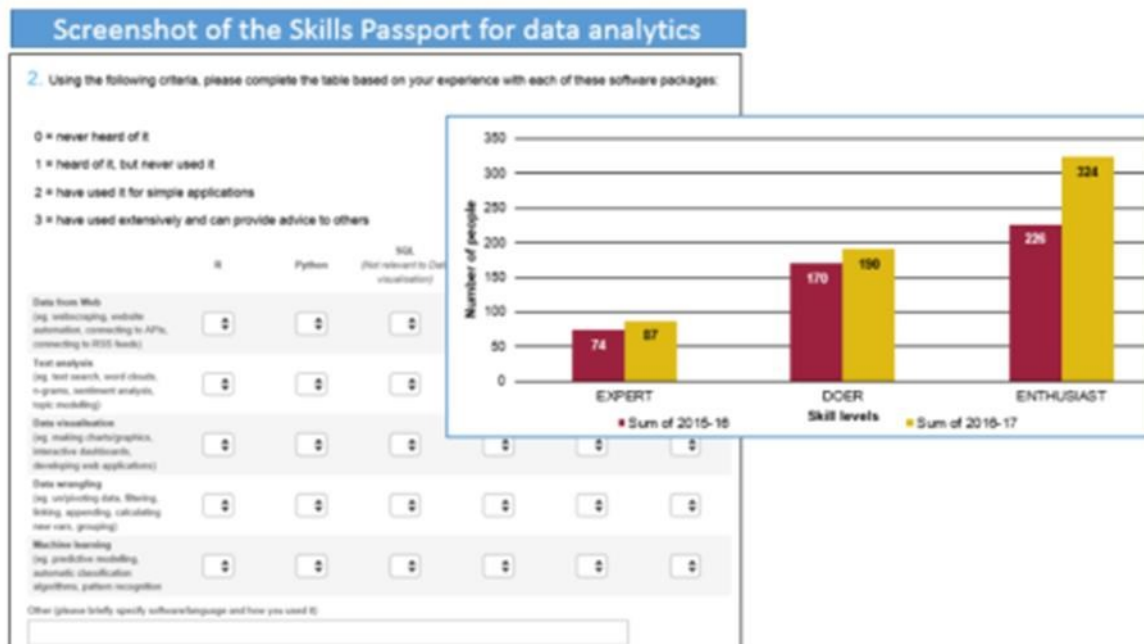
Another interviewee highlighted that capacity building activities are being diffused enabling SAIs to venture into any technological transformation in their audit:

"Concerning Capacity Building in the area of Data analytics, the office has trained All Auditors in the use of at least one analytical tool (…) We have invested heavily in ICT infrastructure (…) Invested in robust security infrastructure. We are also creating awareness to staff" (001k7).

Most SAIs have created an experimental environment thus adopting the "fail forward culture" or "fail to learn culture" of DT (Schlaepfer et al., 2017; ECA, 2020), this alone motivates SAIs to think out of the box and bring out their inner talents. Overall, adopting these new technologies and methods has increased the demand for new skills sets especially in the area of data sciences and IT-related fields. This has gone a long way to increase the diversity of audit organizations. It is not a strange thing today to see people from different fields in an audit team.

Most of the SAI organizations operating innovation labs especially ECA and GAO had

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[33] Kell,M.(2018),Applying data analytics to performance and financial audit: the NAO experience. https://ecademy.eca.europa.eu/pluginfile.php/287/mod_resource/content/0/Applying%20data%20analytics%20to%20performance%20and%20financial%20audit%20%E2%80%93%20the%20NAO%20experience.pdf

the most diverse teams; this can be seen in their job adverts who they are recruiting. Some of these new skills are not required for the sake of performing actual audits but to work as researchers in their innovation labs, ECALab with its text analytics projects employed linguists and data scientists as part of its research team. It emerges clearly, how technology, without an adequate set of skills, competencies, and culture will do little to improve auditing practices:

"Even in the technology-driven audit process human beings would be the most critical factor on account of skill sets required, changes in cultural beliefs and behaviour patterns, and last but not least the reorganization itself. The organizational structure may have to be redefined to facilitate audits from anywhere. This may require a change in roles and responsibilities and redefining the job profiles." (Gupta, 2020).

5.5. Process transformation

The technology dimension of digital transformation has been the focal area of most SAIs when approaching DT. However, most interviewees consider DT as process automation using technology to gain effectiveness and efficiency in audit outcomes. SAIs are striving to automate their audits to meet up with changes occurring in their ecosystem, as a response to the transformation going on in their environment:

"The world of auditing cannot remain untouched by the digital transformation taking place in the audit universe. The technological transformation of the audit universe, on the one hand, may bring in greater accountability and transparency and on the other automating repetitive tasks could free up valuable audit time facilitating a more investigative analysis."

(2) "As a means to perform, efficient and quality audit: By harnessing the latest technological developments in the audit processes, auditors can provide greater assurance to the stakeholders as the examination may move from select samples to the analysis of the whole population" (Meenakshi Gupta, SAI INDIA 2020).

We had mixed findings concerning full automation of public sector auditing processes, some SAI believe it is possible others say it is not. Those arguing against full automation backed their argument using the nature of auditing being a human or behavioural field, difficult to be standardized.

"I think and believe that it is not possible, this is not a physical science, auditing is human sciences our machines will not find it easy to learn from such human behaviour generated data, I just know it's a dream that will not practically occur, don't get me wrong we can automate some part of the audit process, our machines are not smart yet to learn by themselves, such a system won't solve any of my tasks as a performance auditor. All the software behaviour must be fed by us." (Interviewee 001S6).

"New technology is only a tool to identify new problems, but it can't completely replace humans. Technologies can also bring out errors, it can find an inconsistency, but it can't tell us the reasons why it occurred. The interpretation and judgment of audit findings must be made by auditors." (Interviewee 001C2).

The majority of those who believe in the full automation of the audit process, their argument was mainly linked to how auditees are already operating in a full automation environment. However, they think it is not something that will happen to their processes anytime shortly.

"We believe that full automation of the audit judgment process is possible, though still somewhat in the distant future, will not be universal in application. For example, in cases where data is unstructured or we come across data that we haven't seen before, it will be too risky to rely on the judgment of machines. We believe that the auditing profession is still at quite a distance from completely relying on automated judgment. But our target is to reach a stage where we leave most of the data analytics work to machines and let the auditors do more quality work of forming machine-assisted audit judgments, at least for the near future." (Interviewee 001U7).

The school of thought advocating that technology can never replace the auditor argues that even though these technologies are powerful enough to automatically indicate risk or fraud, from that point auditors will take such insides to carry out further investigation to ascertain the actual conditions, causes, and effects of that a more qualitative investigation which machines might be limited, as such, the human and professional scepticism aspect of audits is very difficult for machines to mimic.

"Importantly, AI does not replace professional judgments of experienced auditors in detecting potentially fraudulent activities. While AI can sift through large volumes of data with tremendous accuracy, human intelligence is still an essential element for determining context-specific, proportionate, and nuanced actions stemming from algorithmic outputs. This symbiotic relationship means AI will assist Supreme Audit Institution (SAI) work and will change how that work is carried out—requiring different skills to harness AI's capacity to drive effectiveness and efficiency."(GAO 2020)

The Covid-19 pandemic triggered the automation of certain processes, especially data collection, sharing and analyses. Most strived to upgrade their connectivity to their auditee database to directly query for data, using data online query software they could directly get data from auditee systems, summarize and do exploratory analysis. For example SAI Hungary (SAO):

"…..SAO Hungary uses data for its core auditing and analysis tasks, and digitalization and automation continue to play major roles in requesting and classifying data…The SAO has greatly enhanced digitalization, particularly in requesting data, by transitioning to full-electronic contact with auditees and accessing data using an internet-based request system. This transition has led to more effective and efficient information flow that also markedly increases objectivity and equal treatment." (INTOSAI JOURNAL 2021)

Conclusively, they all agreed to have automated some parts of their work, especially those labor-intensive processes.

6. Discussion and conclusion

Technological innovation has changed and is changing the way public sector auditing is performed (Bonsón and Bednárová, 2019; Schmitz and Leoni, 2019). Digitalization of processes are bringing about an unprecedented change in the way many public services are performed, and how information is produced, shared and used. Public sector audit, and SAI, in particular, is and will be inevitably affected (Hay, 2019). However, to date, the academic literature paid little attention. This study was designed to explore the SAIs' level of perception of the DT phenomenon. Using the DT framework (figure 1) as a lens for this exploratory study, we were able to see what is currently going on to integrate digital technologies and techniques into the auditing process. After collecting, analyzing, and exploring data (semi-structured interviews, professional and academic publications), we summarize our findings based on the following themes:

1)   SAI understanding of the concept of digital transformation in public sector auditing;

2)   Regulations and capacity building to guide the integration of new technologies into the auditing process;

3)   Challenges and opportunities.

In terms of SAI understanding of DT, our analysis shows that most SAIs define digital transformation based on their experiences and exposure (country's level of technological advancement) to certain potentials of technological transformation (innovations). Just a handful of them defined digital or technological transformation strategy using the holistic change management concept. This group painted a more futurist view and had a common character trait of being proactive when it comes to the digital transformation of auditing. SAIs with initiatives such as ECALab, DataLab, or Innovation Labs, in general, were found to be more proactive in their understanding of the digital transformation of auditing. The innovation labs represented a means through which the DT strategy could be transformed into auditing practices in financial, performance and/or compliance audit.

Besides, we reckon that there are no generally accepted standards regulating the integration of disruptive technologies into the auditing process. Despite the need expressed by some of SAI's stakeholders, some of our interviewees think the reality is far-fetched. Auditing by nature is a profession that operates strictly following certain standards and principles in making audit judgments (Appelbaum et al., 2017) and the slow introduction of DT-related auditing standards will slow down the process of transformation. However, to foster the integration of technologies into the public sector auditing process, the INTOSAI has established three working groups concerning DT, namely: Working Group on IT Audit (WGITA), Working Group on Big Data (WGBD), Working group on the impact of science and Technology on Auditing (WGISTA). Looking at these emerging technologies, it is clear they have the potential of disrupting the auditing profession. For example, let us recall the basic principle of auditing which says the backbone of every audit judgment is audit evidence (ISSAI 3000/106). Audit evidence is mainly based on the ability to collect, analyze and interpret data. New technologies can foster this process by extending the breadth of available data sources such as social media

networks, videos, and audio (Moffit and Vasarhelyi, 2013; Vasarhelyi et al., 2015; Yoon et al., 2015; Brown-Liburd and Vasarhelyi, 2015). New technologies enable auditors to obtain evidence through methods and sources that were not previously available. For example, using technologies for animal and plant species inventory in a rain forest reserve, or to measure carbon emission, land consumption. As agreed by our respondents, disruptive technologies and techniques will transform auditing methods. Auditing activities relating to public policy coherence or performances requires an approach where corroborative evidence(s) can be collected, real-time auditing, or continuous auditing can be practised. Digital technologies make it possible for auditors to audit the whole population rather than a sample and this reduces the risk of making a type one or type error in issuing Audit opinions due to wrong sampling. This has the potential to move public sector auditing from a compliance approach to a more emancipatory role, supporting the societal, environmental, and economic changes called by the SDGs (Bebbington and Unerman, 2020; Funkhouser, 2011; Rika and Jacobs, 2019).

Despite the great benefits of digitizing auditing, auditors will and still face a lot of challenges and opportunities, especially when it comes to new skill requirements, audit evidence gathering (big data complexities), new auditing procedures just to name a few. However, auditors will face yet another change in identity in changing the potentiality of their role (Justesen and Skaerbaek, 2010). DT requires new skill sets from auditors, these skills are even at par with the audit technical skills, today's auditors are likened to data scientists with auditing skills. Today SAIs across the globe are carrying out capacity-building activities (e.g. IDI e-learning platform, ECA academy) to beef up their auditor's digital skills to meet up with the challenges brought by the digital revolution. As we described, technology innovation shall go hand to hand with change in culture and people, meaning a shift in the identity of auditors.

At times, the auditee's IT environment is not advanced or up to date to permit the application of data analytics. Data structure and formats sometimes need to be treated and cleaned before being considered as audit evidence. This involves huge costs, which alone causes auditors to abandon certain data due to the high treatment cost involved that surpasses the benefits of using such data. Besides, the cost of running automated systems is very high. Proactive activities towards innovation such as data or innovation labs are very expensive to run, especially for SAIs from less developed countries who are usually underfunded. In terms of structure, SAIs are rearranging their organizational settings to incorporate new hardware and software to accommodate disruptive technologies. For example, the creation of innovation Labs, hiring new data scientists, creating and working in a cloud environment are some of the efforts made to accommodate disruptions. However, looking at the level of reliance on data analytics (automation) in making audit judgments (trusting the Black-Box), the majority of the SAIs interviewed considered data analytic to be a complementary tool in auditing, some confirmed to have in certain situations relied fully on the result of data analytic in making certain audit judgments, especially in cases where without digitization such audits could not have been possible.

Conclusively, we argue that DT can be observed and analyzed by looking at the five elements of the proposed framework (i.e. Strategy, process, organization, people and culture and technology). Our case showed that the majority SAIs tend to give priority to the technological and process dimensions of DT. Other aspects of DT such as organizational culture, digital

transformation leadership, people, strategy are given less attention. What most SAIs are currently doing is process automation, the corroborative evidence shows that there is still a lack of cultural change which serves as a barrier to innovation. SAIs simply introduce technology into their old systems and audit tradition, we believe this approach may risk SAIs not keeping pace with the change and disruption happening in their external environment. We concur that SAIs should take a holistic approach to DT, developing long and short-term audit digital transformation strategies (ECA 2020). They should not be late adopters (Roger, 1983) but act as leaders of digital transformation, in this way they will be able to create impact and remain the relevant voice when it comes to public accountability and transparency, proactiveness should be new culture amongst SAIs this will help them design their future, not being proactive leads to the acceptance of a future designed by others.

The contribution of this paper is twofold. Firstly, it provides one of the first portraits of SAIs' perceptions of the actual and future opportunities as well as challenges DT can bring about in public sector auditing. In so doing, we gave a response to calls in the literature to an empirical analysis of this trend (Bonsón and Bednárová, 2019; Johnsen, 2019). Secondly, we provide a conceptual framework of analysis, as a heuristic device, to observe and understand the factors involved in the DT of public sector auditing. The analysis supported the idea that to comprehend the DT phenomenon it does not suffice to look at a single factor, as DT has several intertwined factors that need to be considered.

7. Limitations and Future research

The present exploratory study is limited in that our qualitative sample of SAIs interviewed was mostly from advanced nations; we had difficulties in collecting evidence from less developed countries to see their level of understanding and practice of digital revolution in auditing. Coupled with the fact that we interviewed only a handful of SAI's, we cannot generalize the findings. Our work serves as a pioneering work into this area, therefore subsequent research is needed. In particular, we call for a comparative research approach looking at specificities of SAIs in particular national approaches to DT, considering the characteristics of SAIs as well as the whole audit eco-system. More research will be needed in looking at specific items of DT and their impact on public sector auditing, auditors, and auditees. In addition, future research may fruitfully look at the changing role, function and identity of auditors in SAIs, as technological innovations advance.

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APPENDIX A: Instances where SAIs leveraged Technology

Organisation	Year	Document Title	data Type/scope	Goal	Technologies Used	type of Analysis	outcome	software
ECA	2019	Big Data Pilot for Performance audits on Eu agencies	Over 200 000 news articles gathered in cooperation with JRC .43 European agencies .Audit time frame from January 2018 to July 2019 (1,5 year) .5 488 distinct sources from all around the world 169 distinct ISO countries 66 distinct languages	What impact could agencies have in the media? (audit question on "external scrutiny" and"accountability") o Total and average news per agency o News duplicates o News outliers + event detection through text mining o Geographical distribution of news sources per agency	text mining	Network analysis Summary statistics	Our analysis revealed that, typically, events related to public safety and public health generate significant news duplicates and news outliers.	python,Tableau,IBM watson

NOA-Estonia	2018	Audit "Publicity efforts of local authorities in municipal newspapers" (2018)	NAO analysed the media coverage of candidates participating in the 2017 . Total of 191 electronically available municipally funded newspapers local elections across municipal newspapers published from January to October 2017 .	The goal was to make sure that newspapers financed by local governments have not been used towards:-personal political interests; covert election campaigns; other party-political image campaigns.	text mining	Analysis using the keywords and combinations of keywords incl: sequence, placement, size, visulizations used, overall „emotion" of the article, connection with elections, author of the article.	The search returned 24 500 results/mentions of keywords (in total 6000 articles) , sentiment analysis(out of the 4 news channels whose articles where analysed ,2 Tv channel tend to have positive sentiments towards particular candidates,while the other two where neutral in their news coverage of candidates)	Outsourced to a Balti Meediam onitooringu Grupp OÜ. Excel for data presentation

NOA-Estonia	2019	Audit "Effectiveness of probation supervision" (2019)	How? – Data from 8 public sector databases 1. Prisoners and probationers register -> probationers' personal data 2. Criminal Records Database -> criminal record 2 years after probation 3. E-dossier system -> criminal record 2 years after probation 4. Enforcement procedure register -> debts, claims by bailiffs 5. Social services and benefits register -> social services and	What and Why? • Community sanctions such as probation are considered to be more efficient than imprisonment. • Efficiency of probation system is measured by the rate of recidivism. Audit question was focusing on possible ways to improve the effect of probation or lower the recidivism. Offenders on probation are affected by: • the service offered by probation system:	text mining	Regression analysis and experiments of using random forest and decision tree	Probation related – The length of the probation officer's responsibility period (+) – Change of probation officers (-) – Social and rehabilitation programs (+) Person related – Addiction problems (drugs and alcohol) (-) – Unemployment (-) – Living conditions and cohabitation (+	texta.ee

		benefits 6. Income tax register -> income and the regularity of income 7. Unemployment and labour market services register -> unemployment status and services provided by Unemployment Fund 8. Population register -> deaths and moving abroad	e.g. professionalism f t e o h probation officers, readiness of the care system (material and skill related); • many other factors - such as addictions, employment, residence characteristics, other kind of services, debts etc.			/ -)	

ECA	2018	Identifying and visualising tonality/emotion and geographical information in the text of ECA Special Reports using IBM Watson and Tableau	ECA special reports	Identifying and visualising tonality/emotion and geographical information in the text of ECA Special Reports	text mining,data visualisation	sentimental analysis(tonality and emotions)	Based on Geo-coverage based on report content (2010-2016) .Chamber III seems to cover the whole world while Chamber II is more focused on Europe and our partners, the USA, Turkey and Russia , with respect to Tonality and emotion in ECA special reports Watson identified „Sadness" because we are missing things (there are deficiencies and problems) ,Wat	IBM watson,Tableau,Python

							son identified „Disgust" as a relevant emotion, because of wastewater-related word,Joy" because follow-ups acknowledge the results achieved words

ECA	2018	EU Customs and VAT audits	SR 19/2017 SR 24/2015	Goal: NOT find all errors - assess control systems • "Are the import procedures robust?" "Are we tackling VAT fraud?	Data Visualisation data Mining		cover the whole world!

SEMI STRUCTURED INTERVIEW PROTOCOL (GUIDE)

TITLE: DIGITAL TRANSFORMATION AND THE PUBLIC SECTOR AUDITING:

THE SAI's PERSPECTIVE

1. General Questions

a. In your standing role and as an institution that champions high standards and practices for public sector auditing, what does Digital transformation mean for public sector auditing?

Follow up questions.

1)

b. What induces you to transform or what influences your digital transformation?

c. How and when is your change process initiated

2. In your view, what are the most promising technologies in auditing practice? And why? As an example:

◆ Big data analytics

◆ Blockchain and smart contracts

◆ Machine learning

◆ Natural language processing

◆ Process mining RPA

3. What have been your experiences so far with the above technologies? What potentials do they have in public auditing?

4. Are there ongoing efforts to propose or draft regulations integrating these technologies into the auditing process?

5. Has the advent of digital transformation increased or decreased your ability to carry out effective auditing? And why?

6. What are the capacity building activities ongoing to help auditors who lack (don't have) data analytical skills, master data analytics (AI) techniques and tools?

7. How has the digital transformation affected your (lets talk about each of them as follows)

a) IT systems

b) organizational structure?

c)Overall strategy

d)Your Audit teams' composition

e) Culture

What changes do you foresee?

8. What are the difficulties you face in implementing technological transformation and what are you doing to overcome these challenges.

9. Do you rely on data analytics, or other technologies, in making audit judgments? If yes to what extent

11. Do you believe full automation of the audit judgment process will help improve audit quality? You can explain with an illustration or example(s)

12. Given the current public sector Audit ecosystem characterized by big data (structured and unstructured data) and digital technologies, are there guidelines at your institutional level defining what information should be considered as audit evidence?

13. How are you working with different stakeholders (government, International Organizations) on big data analytics and other revolutionary technologies like AI, blockchain, etc.?

Chapter 3:

Auditors' adoption and resistance to data mining and analytics: a dual factor approach

Abstract

Despite the usefulness of Data mining and data analytics (DMATTs) in addressing the challenges posed by big data, their adoption and use has been low within the Supreme Audit Institution (SAIs) community. This study was aimed at investigating why the passive or non-adoption behavior by SAIs, even though they audit in a data and technology intensive environment. To address this, the Dual-factor approach was employed, it explains the enabling and inhibiting factors that lead to technology adoption or resistance. With this approach factors from the Technology acceptance model (TAM), Status Quo Bias (SQB) theory with Data mining and analytics specific-Anxieties were combined to explain auditors' adoption and or resistance behaviors. The results reveal that, Data mining and analytics specific anxiety directly increases resistance in individuals while negatively affects their intention to adopt and use DMATTs. Also, DMATTs-specific anxiety negatively affects auditors perceived ease of use and perceived usefulness of DMATTs, which goes a long way to negatively affect their attitude towards DMATTs and eventually their intention to use DMATT. The practical implications of this work suggest that DMATTS-specific anxiety should be addressed when introducing DMATTS to auditors.

Keywords: anxiety, Data mining and analytics, technology adoption, resistance to change, dual factor approach

1. Introduction

In recent times the rapid transformation of both public and private sector auditors' external environment caused by technological advancements amongst others has required both auditing practitioners and scholars in both sectors to review their current practice and to ponder about the future of auditors and auditing (Hay,2020, Ferry et al.2020, INTOSAI,2019, ECA 2020). The Big 4 audit firms and some public sector auditing institutions (e.g., ECA) have made huge investments in sophisticated data analytical tools to help them transition from traditional auditing to more automated auditing using full population as evidence[34] (Freiman, Kim, and Vasarhelyi 2022).

Public sector auditees are becoming more and more sophisticated employing digital tools to enable them deliver services effectively and efficiently to the public. In this exchange between the government and the public, volumes of data are generated on a minute-by-minute basis relating to day-to-day human activities such as using public transport and other public facilities (Brown-Liburd et al, 2019). The data created to consist of both structured and unstructured data (Brown-Liburd et al, 2019), "external data sources continue to expand in terms of both current and interconnectedness" (Brown-Liburd and Vasarhelyi 2015). Auditors may find it challenging when using spreadsheet-like data analytics tools and techniques in processing such near-real-time exogenous big data (Rozario and Issa, 2019, Vasarhelyi et al, 2015).

To properly face challenges brought by the size and unstructured nature of big data, auditors are encouraged both by the profession (professional bodies) and academia to adopt new skills in the area of data mining and analytics, that is , to masters data mining and data analytics tools and techniques(Audimation,2011; PWC,2012; Wang and Cuthbertson,2014; Liu and Vasarhelyi 2014; Vasarhelyi et al. 2015; Warren Jr et al. 2015; Yoon et al. 2015; Zhang et al. 2015; Cao et al. 2015; Appelbaum 2017; Appelbaum et al. 2017)).DMATTs, are Computer-assisted audit tools and techniques (CAATTs)[35] tools that can assist auditors in producing high-quality audits (Braun & Davis, 2003) with a great level of effectiveness and efficiency(Dowling, 2009; Zhao et al., 2004) limiting the occurrence of audit error e.g. type 1 and or type 2[36] (see Barnes 2004).

Due to DMATTs flexible nature, they have been applied in a wide range of fields including but not limited to natural sciences and engineering(Koh et al., 2011, Kovalerchuk et al, 2000;Kohavi et al, 2004; Han et al, 2011;Sasisekharan et al, 1996;Zmijewski et al, 1984; ECA 2020), and in the accounting profession it has been used to perform activities such as fraud

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[34] For more insights see: Byrnes, P.E., Al-Awadhi, A., Gullvist, B., Brown-Liburd, H., Teeter, R., Warren, J.D. and Vasarhelyi, M. (2018), "Evolution of Auditing: From the Traditional Approach to the Future Audit1", Chan, D.Y., Chiu, V. and Vasarhelyi, M.A. (Ed.) Continuous Auditing (Rutgers Studies in Accounting Analytics), Emerald Publishing Limited, Bingley, pp. 285-297. https://doi.org/10.1108/978-1-78743-413-420181014

[35] It is also called: Computer aided Audit tools and techniques CATTs or computer Asisted audit techniques(CAATs)

[36] A type I error (false-positive) occurs if an investigator rejects a null hypothesis that is actually true in the population; a type II error (false-negative) occurs if the investigator fails to reject a null hypothesis that is actually false in the population.

detection(Gray and Debreceny 2014; Papík and Papíková 2020). Adopting these technologies in SAIs auditing work has the potential of improving the effectiveness and efficiency of the audit, and also enhances its reliability (Curtis and Payne 2008).

Data mining and analytical tools and techniques can only be applied when auditors have the required skills to operate such a tool, the act of adopting a novel technique or tool is very important issue in information system research, because it is the first step leading to the application and, also the benefits of technology cannot be experienced or performance cannot be improved if they are not adopted and be used frequently (Davis, Bagozzi, and Warshaw 1989; Venkatesh, Morris, and Davis 2003). Throughout this research, DMATTs tools and skills will be used interchangeably since adopting data mining tools requires adopting data mining techniques and having data mining skills, they all go together.

This research was motivated by recent findings, such as the results of polls conducted by INCOSAI in 2019. The polls revealed that Excel is still the most widely used Computer-assisted audit tools and techniques (CAATTs). In contrast, other data mining tools and analysis languages were ranked at the bottom of the list with very low rates of use. These findings were also confirmed by professional publications, such as an article published on the Wall Street Journal (WSJ)l(Shumsky 2017a,b) .The article called for accountants to retire from using Excel and adopt more modern analytical tools.

Almeida and Pedrosa (2011) found that auditors are not fully leveraging Data mining tools Prior research has also found that, auditors are usually "reluctant to place reliance on more sophisticated and ostensibly more efficient and or effective new audit proceedings even when they are readily available"(Fischer 1996a).It is of importance to this research to investigate why the low adoption of emerging digital tools (DMATTs). However, despite this need for research investigating why the clinging behavior of auditors holding unto the status quo of using traditional tools and techniques and not leveraging modern tools and techniques in this era of technological disruption. Contemporary publications have focused largely on the potential application and impact of these technologies(Debreceny and Gray 2010; Grabski 2010; Gray and Debreceny 2014; Lee et al. 2022; Werner 2017; Werner, Wiese, and Maas 2021) without touching on the "elephant in the room" that is why are auditors not fully employing these tools even when it has been adopted by their organization.

Previous accounting and auditing researchers have focused on the adoption of Computer Assisted Audit Techniques (CAATTs) ,as a whole [37]without a clear distinction ,although some managed to overcome this weakness by focusing on Generalized audit software (GAS)adoption a subgroup of CAATs(Ahmi and Kent 2012).However ,this is still a great weakness in that, the effort both in time and cost needed in training auditors in excel, ACL,IDEA,,SPSS etc can never be matched with that of data mining tools such as python or R(programming languages), excel, SPSS are not suitable in handling unstructured data such as text, audio, video data, or techniques and algorithms used in handling such data cannot be operationalized in excel or SPSS effectively (Eilifsen et al. 2020; Perols et al. 2017; Schneider et al. 2015). Based on such

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[37]Some popular CAATTs: Excel, SAS, SPSS, IDEA, ACL, etc.

assertions it is logical to make a clear distinction between CAATTs and treat them differently.

The few that studied Data mining adoption (Rozario and Issa 2020), have either focused on private-sector auditors or public sector internal auditors who do have a different auditing agenda to that of a supreme audit institution (or public sector external auditor).[38]   In a broader sense they are computer related tools and techniques employed by auditors to retrieve and analyze data (Braun and Davis 2003a), thus even modern data analysis and mining tools and techniques in audits today are a subset of CAATTs tools.   Generally, CAATTs have been seen to have great potential in improving audits effectives .and efficiency (Zhao, Yen, and Chang 2004). Modern CAATTs are able to test 100% of the population increasing auditors' confidence in making informed decisions (Curtis and Payne 2008a; Singleton and Singleton 2011).

Based on the genealogy of each tool or technique, one can see their differences in terms of the reason for their creation, their level of difficulty to master, and their overall scope of application. Differences in various CAATTs, do warrant different ways of approaching or introducing them to auditors, since some were not originally designed for auditing, in other words, consideration should be made with respect to the specifics of each type so as attain satisfactory use and enjoy innovation gain. Intuitively one can safely argue that the level of difficulty in gaining skills in excel for example is lesser compared to programming a data mining algorithm using Python or R.   This heterogeneous view of CAATTs, brings about a more tool specific, techniques specific understanding, thus leading to better strategies aimed at the adoption and usage process, which is so important, since without the effective adoption and use of a CAATTS, the benefits it offers cannot be enjoyed by the organizations (Davis, Bagozzi, and Warshaw 1989a; Venkatesh et al. 2003).

Most studies focused their attention on CAATs software adoption in the private sector auditing community (internal and external auditing). Some researchers focused on the usage or application, even so in the private sector internal and external auditors are different, having different audit objectives. For instance, an internal auditor focuses on operational audits while an external auditor may focus mainly on financial statement audits, this simply shows that their decision to adopt or use a particular technology might be affected by their audit objectives. This analogy supports the argument of this research that since public sector auditors work in a different environment with different audit objectives to that of private-sector auditors, factors that may motivate them to accept, adopt and use a particular technology or technique might be affected by these differences. Private sector auditors work with one client at a time while public sector auditors are faced with government agencies and departments whose activities are often interconnected. Public sector auditors go beyond providing financial and compliance to provide non-financial audits in the form of performance audits, project or program evaluation, and

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[38] CAATTs can broadly be categorized into audit specific tools popular known as Generalized Audit Software (GAS)(Kim, Kotb, and Eldaly 2016), for example: ACL, IDEA etc., and non-Audit specific tools, that is tools generally used by different experts and or stakeholders of other professions, we can loosely say Data mining and analytics to a greater extent can be taxonomized under this category. In other words, any computer related technique and tools use in audits, is taxonomized under the name CATTs.

monitoring.

The primary aim of this study is to explore the factors that might influence the adoption and usage of DMATTs by public sector auditors. Based on the finding's recommendations are given to help Inform SAIs DMATTs decision-making. To attain this aim, a number of objectives were identified, these objectives lead to this research questions that guides this study. Given the great potential of DMATTs in auditing, this research has as objective to investigate the reasons behind an auditor's acceptance or rejection of DMAT. Based on this objective the following research questions are posed:

RQ1: What are the factors influencing auditors 'behavioral intention to accept and adopt DMATTs?

RQ2:   How are these factors affecting their behavioral intention to use DMATTs?

To answer the above RQs. This research adopted the dual factor approach , that is looking at the enabling and inhibiting factors to technology adoption (Cenfetelli 2004),the enabling factors were constructs from Technology adoption model(TAM)(Davis 1989) while the inhibiting constructs where derived from the status quo bias theory (Kim and Kankanhalli 2009; Lee and Joshi 2017; Polites and Karahanna 2012; Samuelson and Zeckhauser 1988a) and technology anxiety literature(Chu and Spires 1991; Gos 1996; Robert K. Heinssen, Glass, and Knight 1987; Powell 2013a; Tekinarslan 2008)

This study contributes to the literature by integrating technology specific anxiety, status quo bias theory (SQB), and TAM, to deliver a more powerful model explaining and predicting adoption behaviors.

The theoretical model was validated with survey data obtained from 206 public sector SAI organizations across the world that have or are using DMATTs. Results indicate that technology specific anxiety, in our case DMATTs anxiety negatively impact intention to adopt DMATTs, indirectly it reduces an individual's perceived ease of use and perceived usefulness of DMATTs, which are both determinants of attitude and behavioral intentions to use DMATTs (Davis 1989).

The rest of this paper is structure in the following manner, section 2 focuses on reviewing CAATTs, DMATTs and technology adoption related literatures, section three (3) focuses on the development of the research model, and section 4 which is the methodology section focused on model evaluation, section 5 was dedicated to data analysis, and section 6 contains the findings, the implications and limitation of the study.

2. Literature review

The use of IT in audits has been a popular trends traceable as early as the birth of microcomputers, however the degree of aid from IT tools vary from tool to tool. For instance Microsoft Word maybe useful for audit documentation and reports writing but lacks the ability to perform audit analytics. The use of IT in audits is generally called Computer Assisted Auditing Tools and Techniques (CAATTs.

The clarity and functionality of CAATTs have always been vague, even the INTOSAI GUIDE 5100 listed just generic functions of CAATTs in relation to IS audits, that is functions such as "user log analysis, exception reporting, field wise totalling, file comparison, stratification, sampling, duplicate checks, gap detection, aging, Virtual field calculations, etc. Despite the acknowledgment that CAATs are capable of handling large datasets, less discussion or attention has been placed on expanding SAI's portfolio to include modern data mining and analytical techniques and tools in SAI's.

GAS related groups of software are amongst the most popular CAATTs amongst auditors (Ahmi 2012). Auditors use GAS to perform data extraction, querying, manipulations, risks assessment, data summarization, high-risk transactions, and unusual items detection, continuous monitoring, fraud detection, data analytics, key performance indicators tracking, testing trends in transactions (Boritz, 2003, Wang. J and Jang,2011). GAS being embedded with audit features, such as sorting, querying, stratifying, and aging still requires auditors to observe, evaluate and analyse results (Wang and Jang 2011). GAS is ranked as one of the most widely used types of CAATTs (Singleton, 2006; Wehner and Jessup, 2005; Debreceny et al., 2005; Braun and Davis, 2003; Lovata, 1988).

Researchers often interchangeably use CAATTs (Ahmi, 2012) when referring to GAS, since it's a subset of CAATs (Ahmi , 2012). Generally, Computer Assisted Auditing Tools and Techniques especially GAS has been proven to significantly improve the efficiency and effectiveness of auditing (Bierstaker et al,2014; Curtis and Payne,2014), Despite these potentials, auditors are still reluctant to adopt new technologies (Debreceny et al.,2005; Janvrin et al.,2008; Payne et al.,2010).

Despite the computational power of commonly used GAS such as ACL/IDEA etc, it cannot deal with complex data such as those generally termed exogenous or unstructured data. Tools and techniques used in Data mining have an edge in that they have a wider range of applications (scalable)[39]. Also, GASs are less efficient compared to general programmable Data Mining tools (e.g. Python and R) when dealing with big and unstructured (usually non-financial) data. As such data may easily overwhelm auditors (Eppler and Mengis, 2004) when using traditional tools. Data mining tools and Techniques deemed by researchers to be the perfect tool to handle such data since it has more sophisticated features capable of handling structured and unstructured Big Data. Data mining is considered to be one of the most important technological advances in contemporary business analytics and decision-making support tools (Amani and Fadlala, 2017), but has been the least researched area in accounting information system research (AIS) (Amani and Fadlala,2017).

2.1. Data Mining and analytics in the public sector Auditing environment

In recent times the advancements in technology have caused government operations and transactions to become more sophisticated and digital there by creating data on a near real-time basis(Klievink et al. 2016). e-Government became a buzzword(Hofmann, Räckers, and Becker

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[39] Examples of GAS packages commonly used include SAS analytic Intelligence, Oracle, SQL, easytrieve Plus, Report writer, Brio, AS/400 Query, BancAudit, Business object, Cognos, Hyperion, MOnarch, The Number, PeopleSoft, Audit Command Language (ACL), Interactive Data Extraction and Analysis (IDEA) DB2 intelligent Miner for Data, DBminer, Microsoft Data analyzer, CaseWare, Lotus, SAS enterprise MIner, etc.

2012; Homburg 2008) in modern public administration due to the strive for more effective and efficient delivery of public goods and services by Governments(Elezaj, Tole, and Baci 2018; Munné 2016). Most governments, if not in full, partially deliver services using electronic platforms-government. They are evolving to what is now known as smart government(Scholl and Scholl 2014) where technology is such as Internet of Things IoT an AI are integrated to deliver government services(Gil-Garcia, Zhang, and Puron-Cid 2016; Kankanhalli, Charalabidis, and Mellouli 2019). These systems generate new forms and types of data (structured and unstructured)(Yukhno 2022), in turn these new data forms are new sources of audit evidence that need new audit methods and tools such as data mining and analytics to collect analysis and use data (new audit evidence)(Adnan and Akbar 2019; Che, Safran, and Peng 2013; Elgendy and Elragal 2014; Grover et al. 2018; Kutz 2003; Saggi and Jain 2018; Tsai et al. 2015).

Today auditors not only operate in an environment where government generates data but also governments use technologies such as AI to make decisions and oh policies(Mcneely and Hahm 2014; van Noordt and Misuraca 2022) .According to IBM, about 80% to 90% of the world's data is unstructured(Isson 2018; Tam Harbert 2021)[40]. Researchers argue that data mining is the perfect tool in this our data driven era, as it is capable of handling the complexities of big and unstructured data that could make evidence assessment difficult and complicated (Chong and Shi 2015)

American Institute of Chartered Public Accountants Considers DM to be one of the top ten technologies for tomorrow, while the Institute of Internal Auditors has prioritized data mining as one of its main research priorities (Koh,2004). Auditors today find themselves in an "information-intensive environment (Curtis and Payne, 2014), thus the use of IT tools is becoming inevitable and could go a long way to increase their efficiency and effectiveness leading to an improvement in the quality of their audits (Braun and Davis, 2003; Curtis et al., 2009; Dowling and Leech,2007; Bedard at al, 2008).

In auditing, Data mining and analytics can be applied at all stages of an audit (Appelbaum, Kogan, and Vasarhelyi 2018)that is from the planning phase (performing activities such as risk assessment, audit planning, and design, selection of audit topics and audit objective, aim and question formulation) during the actual audit (performing substantive testing, a test of controls, etc), reporting phase (audit reporting)(Amani and Fadlalla, 2017, Appelbaum et al, 2016). , during the post Audit phase (measuring the impact of an audit).

According to the literature review of Amani and Fadlalla(2017) on the application of data mining in Accounting, two-thirds ⅔ of the accounting practices of data mining was in the area of assurance and compliance, with a huge application focusing on predictive data mining followed by descriptive and a very little application in prescriptive analytics task. Research has proven that auditors are usually "lazy" when it comes to dealing with non-financial information, this thus affects their ability to identify fraud or inconsistencies in certain situations (Brazel et

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[40] According to the IDC project this number will be 65% by 2025

al., 2012:24). In the same light Cohen, Krishnanmorthy, and Wright (2000) found that auditors are more focused on financial trends as opposed to non-financial information which is mainly used as corroborative evidence. Such behaviours could cost the auditors of this era, whose ecosystems are dominated by unstructured non-financial data. Especially with the case of SAIs auditing governments whose vast majority of data is unstructured(Eggers, MALIK, and Gracie 2018)

Recently, the whole world has envisaged substantial growth in the use of end-to-end data mining methodologies such as CRISP-DM(Cross-industry standard process for data mining)(Chapman et al, 2000; Santos & Azevedo, 2005), KDD(Knowledge Discovery in Databases) process(Fayyad et al, 1996; Brachman, Anand, 1996), and SEMMA(Sample, Explore, Modify, Model, Assess)(SAS,2008). Most of the time scholars consider data mining as a synonym of knowledge discovery for data (KDD), meanwhile in reality it is a very essential step in the KDD process.

Tangsripairoj and Samadzadeh (2003), asserts that "data mining is an advanced data analysis techniques whose primary function is to extract likely useful knowledge or hidden patterns from large databases".

Today auditees are adopting new advanced technologies automating and improving their system .Auditors also are gradually following the trend to meet up with the demands of these new systems however the focus has been greatly on financial audits (FA).Research publications also have been focused more on studying the application of data mining in FA (Green and Choi,1997; Fanning and Cogger, 1998; Forez et al., 2000).

2.2. SAI audit ecosystem

The demand and need for better and efficient services to its citizens has triggered governments to adopt e-government. (Al-Mashari.,2007; Evans & Yen.,2006; Gil-Garcia & Martinez-Moyano.2007; Reddick,2006; Shareef,Kumar,Kumar & Dwivedi,2009;Sprecher,2000).It is perceived that ICT enhances efficiency ,serveice quality and accountability which area all principles of public management philosophies such as NPM(Cordella and Bonina 2012).That is the ecosystem where public sector auditors find themselves today is characterized with governments adopting and operating big databases (e-government data warehouses) thus using traditional tools would be very difficult for auditors to gather or access all potential audit evidence.

The growth in government data bases and or e-government, can be   traced to the advent of NPM(Homburg 2008; Scott and Robbins 2010).E-government has evolved to open government , providing more access to huge government data to the public(Abu-Shanab 2015; Felix Júnior et al. 2020; Misuraca and Viscusi 2014). In order to enjoy the benefits of open data, governments had to update their systems from manual to digital transition to what is generally called E-governments or electronic government operationalised through strategies aligned with open government data, to improving efficiency and transparency, responsibility or accountability of government (Kraemer and kings,2003; World Bank,2000)

The Open Government Data (OGD) creates public value (Harrison et al., 2012) by providing transparency (Parycek, Hokhtl & Ginner.,2014), citizens participation, and collaboration with the government (Moss & Coleman 2014), efficiency and effectiveness of government activities and or policies (Janssen $ Kuk,2016; Pereire et al., 2017) and finally confidence and trust in government (O'Hara,2012).

E-government offered services also have increased the amount of data in government data warehouses and also that the nature of data has changed drastically including everything (complex, unstructured big data). This could be challenging to auditors when approaching such a data ecosystem manually, or with traditional tools. In general, the advancement in data collection technologies has facilitated the creation, collection, and use of data (Chen, Chiang, and Storey., 2012).

These days the bulk of SAI's evidence are in the form of "computer-processed data such as data extracts from databases or software applications, data maintained in spreadsheets, data collected from forms and surveys on web portals" (IDI PA ISSAI Implementation Handbook, 2020. p. 127)

To ease their work, auditors these days sought to adopt GAS and other CAATTs, these tools and techniques are increasingly becoming inevitable in audit engagements(Wang and Cuthbertson 2015).

SAIs are encouraged to reinforce the use of CAATTS in all phases of the audit (OECD SIGMA 2005) and Data mining could be that addition that could elevate and improve the capabilities of SAI's current "CAATTs Arsenal" giving them the edge in producing quality audits and providing public accountability.

The challenging environment (Solomon and Trotman 2003,409) by default puts pressure on SAIs and or the audit profession in general to improve audit efficiency and effectiveness (Chaney et al.,2003; Bierstaker et al,.2006).

Although, Data analytics might not be new in auditing, but the volume of data today can overwhelm "traditional auditors", the degree of application before now was limited especially due to lack of computing power and or simply conservativeness to change (ZHAOKAI., 2019 ;Manson et al. 1997; Alles 2015; Fischer 1996) .Tools such as modern data mining techniques and tools could speed up analysis and knowledge extraction in data (O'Donnell. 2015). Data mining and analytical techniques would drastically reduce inefficiency during the audit process, for instnace data mining could help auditors to discover certain patterns and outliers and more risky parts in the audits thus the time that could have been spent on repetitive ratification or number-crunching activities would drastically be reduced ,the audits then would be more focused on important and risky areas (Appelbaum, Kogan, &Vasarheyli,2017; Byrness et al., 2014; Cao et al ., 2015; O'Donnell; 2015). Analytical Procedures in External Auditing presented by Appelbaum, Kogan, &Vasarheyli (2017), shows a systematic classification of data mining and analytical methods that are applicable at the various stages of a traditional process of an audit. Technique ranging from data analytics methods such as regression to data mining related algorithms such as support vector-machines (SVM), genetic algorithms etc.

ISA 330 on audit states; evidence sufficiency can be attained through the power of Data mining which scans through the whole data (population) leaving nothing untouched. Data mining is gradually being adopted by some SAI's e.g NAO uses text analysis/catalogue analysis in its performance audits, while in financial audits they perform, purchase to pay analysis, payroll analytics, journal testing (24th UN/INTOSAI Symposium 2017).

2.3. Technology adoption research in auditing

Recently there has been a growing discussion on the potentials and impact of technological innovations on the quality and effectiveness of auditing (Sivarajah et al. 2017),data analytics, machine learning ,artificial intelligence, data mining , robotic process automation, drones(unmanned arial vehicle) are gaining traction in the accounting information system literature (Alles and Gray 2016; Amani and Fadlalla 2017; Cao, Chychyla, and Stewart 2015; Kokina and Davenport 2017; Moffitt, Rozario, and Vasarhelyi 2018).

AIS research on technology adoption is becoming popular, due to the importance placed on adoption as the first step in order to benefit from any technology. Research on technology adoption in audits in particular has been growing exponentially, particularly focusing on CAATTs or on technologies in general(Bierstaker et al. 2003; Bierstaker, Janvrin, and Lowe 2014a; Curtis and Payne 2008b; Huang, Hung, and Tsao 2008a; Janvrin, Bierstaker, and Lowe 2008; Li et al. 2018; Lowe et al. 2018; Mahzan and Lymer 2014a; Pedrosa and Costa 2014; Pedrosa, Costa, and Aparicio 2020; Rosli, Yeow, and Siew 2012; Siew, Rosli, and Yeow 2020a; Vasarhelyi and Romero 2014),more specifically some focused on GAS(Ahmi and Kent 2012a; Bradford et al. 2020; Debreceny et al. 2005; Henderson, Bradford, and Kotb 2016; Kim, Kotb, and Eldaly 2016; Widuri 2016), and more recently on artificial intelligence, Robotic process automation(RPA) data mining and analytics etc(Cooper et al. 2019; Schmidt 2018; Schmidt et al. 2020; Schmidt, Church, and Riley 2019; Seethamraju and Hecimovic 2022)

Research in accounting information systems, particularly research on CAATS have been done either looking at constructs affecting the adoption (Bierstaker et al. 2014a; Curtis and Payne 2008b; Janvrin, Bierstaker, and Jordan Lowe 2009; Payne and Curtis 2017; Pedrosa et al. 2020; Siew, Rosli, and Yeow 2020b), with very or few on resistance (Schmidt et al. 2020) or on the duality approach (Henderson et al. 2016). This study strives to contribute in this Area by taking a dual factor approach (Tsai et al. 2019a) that is, to explore DMATTS adoption and or usage through the lenses of the dual factor concept which takes into consideration "enablers" and "inhibitors" (Tsai et al. 2019). Tsai et al. (2019) applied the duality concept, by using the technology acceptance model (TAM)(Davis 1989a, 1993) for enablers , and the Status Quo Bias (hereafter SQB)(Kim and Kankanhalli 2009; Samuelson and Zeckhauser 1988) for resistance, with this they were able to determine factors that may affect an individual's decision to accept or reject a new technology.

Being inspired by their work, this study applied a similar approach of dual factor, but added a technology specific aspect, that is we added anxiety specific to data mining and analytics. Adoption of a new technology usually requires time for learning and adaptation/adjusting or efforts, this may lead to an adopter wanting to maintain their current status quo (Kim and Kankanhalli 2009; Samuelson and Zeckhauser 1988) or adopting conservative behaviour.

Nah, Tan, and Teh (2004) argues that user acceptance does not necessarily mean there was no resistance, especially when the resistance was mandatory. In such case implicit resistance behaviours must be taken into consideration, since it affects the smooth or effective implementation of a new technology, thus a model considering both negative and positive factors in studying technology implementation and users' behaviours, may increase the explanation.

Prior studies have expressed the possibility of a theoretical lens capturing this dual concept (Joshi 2005; Martinko, Henry, and Zmud 1996), others have proposed models capturing resistance and acceptance aspects in technology implementation (Kim and Kankanhalli 2009; Tsai et al. 2019a). The importance of applying the duality approach stems from the assertion that, when an individual is making technology adoption decision , they usually are influenced by factors that re positive leading to acceptance or factors which are negative leading to non-adoption or resistance(Bhattacherjee and Hikmet 2007a), as such when focusing a research towards one direction e.g. looking at non-acceptance by using the resistance concept or theory , researchers fail to capture the full picture of what led to the failure in implementing a particular technology (Dünnebeil et al. 2012; Joshi 2005; Kim and Kankanhalli 2009; Rana et al. 2016) .Acknowledging that no single paper applying the dual factor approach can explain all factors affecting individuals decision to accept or reject a new technology,However, the dual factor approach is a perspective guiding research , leading to a more holistic appraoch when investigating behaviours of individuals in the case of adopting a new technology.

There is limited research in accounting and auditing looking at the adoption of data mining and analytics, using the dual factor perspective, most studies are focusing on CAATTs in general or even when focusing on data analytics, they focus, either on adoption (positive) (Curtis and Payne 2008b; Janvrin et al. 2009) or resistance (negative) (Schmidt 2018).

Resistance here is loosely defined as" the ways one tries to avoid something, while acceptance is the person's assent to the reality of a situation and recognizing a process or condition without attempting to change it or protest it" (Tsai et al. 2019a).

Cenfetelli (2004) argue that a vast majority of information system research has focused on factors that enables system success, adoption and usage (e.g., Davis 1989a; Davis et al. 1989a; Venkatesh 2000). He pointed the source of this drift towards positive aspects of IS system implementation to be the "implicit assumption that the inhibitors of usage are merely the opposite of the enablers". Cenfetelli (2004) went on to propose reasons why the inhibitors are very essential when studying IS implementation. According to his arguments, perception geared towards the discouragement of IS usage do exist and are different from those that encourages usage, the two perceptions i.e., the "inhibitors" and "enablers" are independent but can coexist.

Finally, factors affecting both perceptions and their consequences on individual behaviour are different, this is why he concluded that by adding the inhibitors perception increases our understanding of usage or rejection behaviours.

Resistance is different from non-adoption in that, non-adoption is a complete refusal or outright denier while resistance may take the form of user avoiding newly adopted system. This resistance might be hidden but "dangerous toward" the implantation of a new system. This

same argument is in line with Herzbergs two factor theory(Lundberg, Gudmundson, and Andersson 2009) , which asserts that motivational factors may cause job satisfaction , but without them does not mean the opposite exist i.e dissatisfaction, same logic was applied in the other part of the theory i.e., hygiene factors may lead to job dissatisfaction but their absent does not imply job satisfaction, same as trust and distrust see (The et al. 1998).

Based on the dual factor approach constructs were broadly divided into enablers (from the technology acceptance literature) and inhibitors (mainly from the IS[41] resistance literature), this approach is greatly inspired by prior literature (Cenfetelli 2004; Cenfetelli and Schwarz 2011; Kim and Kankanhalli 2009; Tsai et al. 2019a).

In AIS research, this work is situated under the group of research looking at information systems or technology adoption from and individual level, this is the case with previous CAATTS adoption related research (see Ahmi and Kent 2012b; Banker, Chang, and Kao 2002; Bierstaker, Janvrin, and Lowe 2014b; Braun and Davis 2003b; Curtis and Payne 2008b; Huang, Hung, and Tsao 2008b; Janvrin et al. 2009, 2008; Kim, Mannino, and Nieschwietz 2009a; Mahzan and Lymer 2014b; Mootooganagen Ramen, Bhavish Jugurnath, and Bhavish Jugurnath 2015),data mining and analytics adoption related research(Schmidt et al. 2020). Despite following the individual level of investigation, it deviates from previous studies on CAATTs and specifically deals with data mining and analytics adoption by applying the dual factor concept or approach (Cenfetelli 2004).

3. Research model and hypothesis

The research model as presented in figure 1, was constructed with constructs from TAM(Davis 1989; Davis, Bagozzi, and Warshaw 1989a) representing enabling factors , while constructs from the status quo bias theory (Samuelson and Zeckhauser 1988), and computer anxiety (Robert K. Heinssen et al. 1987) represented technology adoption inhibiting factors. In summary this study builds on and is guided by previous research on dual factor theory(Cenfetelli 2004; Cenfetelli and Schwarz 2011; Tsai et al. 2019), to posit that TAM model related factors are enablers while the SQB theory and related factors such as anxiety to be inhibitors.

3.1. Enabling Factors

Prior, Accounting Information System (AIS) researchers on so many occasions have made use of Technology acceptance models and theories to analyze and evaluate auditors' attitudes and reactions towards the adoption and actual use of CAATTs (Bierstaker et al,.2014. Curtis and Payne, 2008; Vasarheylyi et al,2012; Curtis and Payne, 2107, Widuri et al 2016, Rosli et al, 2013, Widuri et al,2019; Ahmi and Kent, 2012; Janvrin et al,2008; Schafer Na Eining,2020; Gonzalez et al, 2012). This research also follows a similar approach of sourcing constructs from established information system adoption related research to explore public sector Auditors' behavior towards adopting and using DMATTs.

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[41] Information System (IS)

Being inspired by the different TAM models, TAM(Davis 1989),TAM2(Venkatesh and Davis 2000a),TAM3(Venkatesh and Bala 2008a), the two most common predictors of a user's behavior that is Perceived ease of use (PEOU) and perceived usefulness (PU) were adopted. It has been previously argued and proven that PEOU and PU are key perceptions of an individual capable of impacting their behavioral intention to use or adopt a new technology (Davis, Bagozzi, and Warshaw 1989b; Venkatesh and Davis 2000b). Davis et al. (1989) asserts that, external variables of TAM (e.g., organizational support) may affect behavior throughs effects on one's beliefs. These effects on intention is being mediated by perceived ease of use and perceived usefulness(Venkatesh and Davis 2000a).

Previous studies investigating the adoption of data mining (Huang, Liu, and Chang 2012) and CAATTs(Huang, Hung, and Tsao 2008; Kim, Mannino, and Nieschwietz 2009) have applied TAM. One of the strengths of TAM posited in the literature, has been its omnipresent nature (Venkatesh and Davis 2000b) in other core technology adoption models.For example TAM1(Davis 1989),was inspired by and derived from the Theory of Reasoned Action(TRA)(Fishbein and Ajzen,1975), an extension such as Theory of Planned Behavior(TPB)(Ajzen 1991),to specifically study user acceptance of information system by explaining behavioural intensions to use the new system (Hsu and Lin 2008).In other word the underpinnings of TAM are found in TRA, TPB.

TAM argues that , the behavioral intentions of an individual in adopting and using a technology , can be determined by two beliefs, perceived usefulness and perceived ease of use(Davis, Bagozzi, and Warshaw 1989c; Venkatesh and Bala 2008b).This has also been confirmed with other outcome variables such as attitude towards using IT(Davis et al. 1989a; Venkatesh and Davis 2000a).

This study like others (Tsai et al. 2019a) extends TAM with the guidance of the dual factor approach (Cenfetelli 2004).It did so by looking at enablers and inhibitors that may affect perceived ease of use and perceived usefulness and eventually behavioral intention to use. The constructs selected took into cognizance differences in adopter's characteristics and system characteristics (in this case DMATTS) (Venkatesh and Bala 2008b).

According to TAM (Davis 1989; Davis et al. 1989c), Perceived Usefulness (PU) and perceived ease of use(PEOU) are individual level believes that may be negative or positive towards the adoption of a new information system, that is these perceptions shapes one's behavioral intention. In CAATTs related research TAM constructs of PEOU, PU have all strongly supported and validated the claim of TAM's ability to predict behavioral intention to adopt CAATTS(Kim et al. 2009).

3.1.1. Perceived Ease of Use
Perceived ease of use is considered one of the core constructs of the TAM that has explanatory power to explain the technology adoption process in many different fields. According to Venkatesh et al. (2003), perceived usefulness is directly affected by perceived ease of use because easy systems reinforce the system's efficiency and usefulness. With respect to DMATTs adoption, Perceived ease of use can be defined as "the degree to which an auditor believes that using DMATs would be free of effort" (Davis, 1989). In line with this definition, two hypotheses on perceived ease of use (H2a and H2b) are defined as follows.

H1a: Perceived ease of use is positively associated with user's Attitude towards DMATTs

H1b: Perceived Ease of Use is positively associated with user's Perceived usefulness of DMATTs.

3.1.2. Perceived usefulness (PU)

PU captures an individual's action of forming beliefs on performance of a new technology , Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance". Empirically perceived usefulness have been proven to be an effective determinant of behavioral intention(Davis et al. 1989a; Venkatesh and Davis 2000a) and attitude toward usage(Davis 1989; Tsai et al. 2019b).Researchers have found it to be a primary variable which explains why individuals develop positive or negative behaviors / attitudes towards a new technology and their intention to use it (Davis et al. 1989c; Holden and Karsh 2010).Thus we hypothesis that:

H2a: Perceived usefulness is positively associated with user's Behavioral intention to use DMATTs.

H2b: Perceived Usefulness is positively associated with user's attitude towards using DMATTs.

3.1.3. Organizational Support

Igbaria and Chakrabarti (1990) posits that management support can be of two main categories;(1) application development specific support, which includes the presence of facilitators such as, an information center, assistance toward development, manuals and guides in using the new system.(2) general support , such as the allocation of resources , management encouragement and motivation. Both types of support are all geared towards cultivating an organizational climate conducive for a smooth adoption and implementation of a new technology.

Prior researchers have posited that , organizational support is key to the successful implementation and acceptance of a new technology (Compeau and Higgins 1995; Igbaria et al. 1997; Igbaria, Guimaraes, and Davis 1995).Igbaria et al. (1997) findings confirms management support positive impact on perceived ease of use. This result has been confirmed by the findings of(Bhattacherjee and Hikmet 2008; Igbaria, Parasuraman, and Baroudi 1996). organizational support while enabling adoption reduces individuals resistance to change to a new systems. Studies have provided evidence of organizational support negatively affecting resistance to change (Kim and Kankanhalli 2009; Oschinsky, Stelter, and Niehaves 2021; Schmidt et al. 2020)

H3a   Organizational support is negatively associated with User's resistance to DMATTs.

H3b   Organizational Support is positively associated with Users attitudes towards using DMATTs.

3.1.4. Self-Efficacy (SE)

Self-Efficacy or Computer Self-Efficacy as it's generally known in IS research is a construct that relates to a person's belief on his/her ability to use information technology (Shihab,

Meilatinova, Hidayanto, & Herkules, 2017). People who are prone to the use of technology tend to be more confident and more willing to use the technology. Previous studies provides evidence of a positive impact of self-efficacy on technology acceptance decisions (Relating & Nel, 2011). In line with the scope of this study, self-efficacy is defined as "The degree to which an auditor believes that they have the ability to perform a specific task/job using the CAATTs" (Compeau & Higgins, 1995a, 1995b).

Self-efficacy is one of the Two Basic mechanisms of TAM by which perceived ease of use influences attitude(Davis et al. 1989a).Some researchers have expressed the importance of linking SE to perceived ease of use (Chou 2001; Davis and Venkatesh 1996; Thatcher et al. 2008) ,others have tested the relationship between SE and PEOU and found a very strong positive impact of SE on PEOU(Agarwal and Karahanna 2000; Igbaria and Iivari 1995)

Also, researchers have tested the relationship between SE and resistance to change(Bhattacherjee and Hikmet 2007; Kim and Kankanhalli 2009), results provided evidence of self-efficacy affecting resistance to change. Individuals with low levels of self-efficacy are more likely to resist the introduction of a new system. Based on the above we hypothesis as follows:

H4a   Self-efficacy in DMATTs is positively associated with perceived ease of use.

H4b   Self-efficacy in DMATTS is negatively associated with DMATTs resistance.

3.2. Inhibitors

Inhibitors are a user's perception about a system's features that negatively affects their decision to use or adopt the system(Cenfetelli and Schwarz 2011).In this study adopted the SQB and related concepts such as anxiety to explain inhibitors to DMATTs adoption intensions.

SQB proposes that individuals prefer to stay in the same lane or in same situation or way of doing something even though they are presented with a much better option(Kim and Kankanhalli 2009; Samuelson and Zeckhauser 1988b).The status quo bias theory, strives to explain why people or someone may prefer to maintain their "current status or situation" when faced with change propositions (Kim and Kankanhalli 2009).

SQB was first explicitly used in information system research by Kim and Kankanhalli (2009),they used it to explain adoption inhibiting factors, that is switching cost as an adoption inhibitor   increases resistance to change to a new system .

SQB theory suggest that individual decision makers naturally have biases when making change decisions, that is, they have natural inclination to maintain the status quo, and thus such inclination can be a source of barrier to change(Samuelson and Zeckhauser 1988b).

With respect to SQB perspective, biases may result from the rational decision-making process, cognitive misrepresentation, and psychological commitment.

In rational decision making , biases may arise when an individual takes into consideration the cost involve in switching from the status quo to the new system, that is, when faced with alternative, a rational decision maker evaluates the relative cost and benefits before making any change decision .An individual may choose not to adopt a new and more effective system ,

when they perceive that the switching cost in terms of effort and time required for transition outweighs the potential gains they might receive from the alternative .Instances of uncertainty about the potentials gain an alternative can offer are also sources of rational decision making bias, in other words people prefer the known to the unknown (Polites and Karahanna 2012).Even in cases where the organisation already adopted the new systems , individuals may still go through an initial sense making process evaluating the new technology to make meaning out of the system in relation to their work, they do so if they fail to obtain usefulness in the new system or when the usefulness of the system is unclear and doesn't fit their expectations(Maitlis, Vogus, and Lawrence 2013)

An example of cost in this category of status quo bias is switching cost with subtypes such as transition cost(Gong et al. 2020; Hsieh 2016; Hsieh and Lin 2018; Kim and Kankanhalli 2009). SQB may also be explained through cognitive misrepresentation resulting from loss aversion , as posited by (Kahneman, and Tversky 1979).Individuals apply loss aversion when making decisions that is they have the tendency to attribute more weight to losses than to gains, this later translates to individuals having a strong tendency to remain at the status quo(Kahneman, Knetsch, and Thaler 1991) when they perceive a loss .In information system research, Polites and Karahanna (2012) asserts that , loss aversion together with other status quo biases(i.e. psychological commitment and rational decision making)may manifest externally as inertia(Samuelson and Zeckhauser 1988b).

Finally SBQ can be explained by psychological commitment to an 'existing course'(Samuelson and Zeckhauser 1988b).This category of SQB , consist of cost such as , sunk cost. Psychological commitment is an act of implicitly or explicitly pledging to continue a relationship(Dwyer and Oh 1987; Rauyruen and Miller 2007).It attempts to explain why people worry in making perceived irreversible wrong decisions(Lee and Joshi 2017),under this category sunk cost is consider as a value of previous commitment(Samuelson and Zeckhauser 1988a).

3.2.1. Resistance to change (RTC)

Resistance entails negation to something that is a negative attitude toward a system or technology Cenfetelli (2004) calls this behavior, 'inhibitor' to adoption. In this case resistance estimates a user's opposition or negative reaction behavior towards a new system.As asserted by Gibson (2004), resistance is a common occurrence when a new technology is introduced. Previous works have applied this construct in studying users' adoption and use behaviors(Bhattacherjee and Hikmet 2007; Norzaidi et al. 2008; Schmidt et al. 2020). They found a strong negative relationship between resistance to change and behavioural intention to use(Hsieh 2015b; Hsieh and Lin 2018),thus:-

H5   Resistance to change is negatively associated with user's Behavioral intention to use DMATTs.

3.2.2. Inertia

Polites and Karahanna (2012) posited that, inertia occurs when an individual resist to adopt a new system despite having awareness of superior benefits provided by the new technology. They defined it with respect to information system research as "*users' attachment to and*

persistence in, using an incumbent system (i.e., the status quo) even if there are better alternatives and incentives to change".

According to Bem (1972) and Petty and Cacioppo (1981), this may be due to the tendency of individuals relying on their past knowledge and experiences when making decisions. Which may "blur their view "from seeing the benefits offered by an alternative, thus leading to poorly perceiving the relative advantages offered by the alternative to the incumbent system. To sum it up , inertia can be seen as the act of maintaining rigid adherence to the status quo(Polites and Karahanna 2012)

Polites and Karahanna (2012), conceptualized that inertia can be behavioral, cognitive and affective in nature, after reviewing sources of inertia found in prior literature, they were able conclude that, inertia can be a conscious (e.g. switching cost perceptions), and subconscious(habits).In auditing , prior researchers have found inertia-like behaviors in auditors , when they are faced with a new techniques or technology(Bedard 1989; Biggs and Wild 1984)[42]

Empirically researcher have previously tested the degree to which inertia affects perceived ease of use (Polites and Karahanna 2012; Tsai et al. 2019b), perceived usefulness(Tsai et al. 2019b) ,resistance to change (Hsieh and Lin 2018; Kim, Lee, and Rha 2017) and behavioural intention(Polites and Karahanna 2012).

Findings shows that, inertia positively affects Resistance to change (Balakrishnan et al. 2021; Hsieh and Lin 2018), while negatively affecting perceived usefulness and perceived ease of use (Lucia-Palacios, Pérez-López, and Polo-Redondo 2016; Polites and Karahanna 2012).It has also been argued that inertia and resistance are overlapping constructs(Seth et al. 2020)

H6a   Inertia is negatively associated with Perceived usefulness.

H6b   Inertia is negatively associated with Perceived ease of use.

H6c   Inertia is negatively associated with user's Behavioral intention to use DMATTS.

H6d   Inertia is positively associated with Resistance to change.

3.2.3. Computer Anxiety-DMATTs Phobia
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Chang (2005) defined computer anxiety as "*the generalized emotion of uneasiness, apprehension, anxiousness of coping, all the stress in anticipation of negative outcomes from computer related operations*". From this definition, one can safely say DMATTs, and

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[42] "(Biggs &Wild, 1984,p. 71) Finding that auditors tend to rely on relatively unsophisticated analytical review procedures even though the use of more sophisticated procedures available to them would presumably allow the auditors to conduct more efficient audits without sacrificing effectiveness"(Fischer 1996b)

programming anxieties are subsets of computer anxiety as they are all computer related operations.

From Anderson (1996) computer anxiety rating scale, we derived the DMATTs anxiety scale, however care was taken in deriving constructs that captures the characteristics and or features of DMATTs.

Huang et al. (2012), found that computer anxiety is not a critical factor when predicting perceived ease of use, their findings was supported by the fact that most white collar blue collar staff use computers as a generic tool, they use it even for internal communication such as e-mail, video conferencing etc. therefore we argue that, testing computer anxiety generally amongst auditors may not produce a significant result as auditors today especially those in developed nations use computers as a generic tool, based on this we shift our attention to look at anxiety resulting from a specific application of computer in our case data mining and data analytical tools and technics related anxiety. Tapping from the computer anxiety literature one may encounter anxiety resulting from lack of training (Igbaria, 1993), educational level (Chou and Tsai,2009), educational Major (Chou,2003), experience/use(Anne and Powel), like the case of computer anxiety these factors may determine the level of anxiety of a user towards data mining and data analytical tools and techniques. Based on the definition of computer anxiety (Chang, 2005) and technophobia we define DMATT phobia/anxiety as:

"The feeling of anxiety encountered or resulted from encountering DMATTs in any form, be it performing a DMATTs task, or using a DMATTs output or results."

3.2.4. DMATTs anxiety constructs

For an auditor to effectively use DMATTs, they need to have new skillsets such skills in statistical analysis which can be related to using different programming software, to enable data retrieval and analyze data, results interpretation and reporting. Obviously, these skills are obtainable through learning efforts. Since DMATTs is based on algorithms, skills in programming through which these algorithms can be operationalized are also very essential. In other words, Programming is a very key skill to have. These skills are usually out of the generic skill set of an average public sector auditor, especially those working on performance and compliance audits. Pedrosa and Costa (2012), argued that auditors still prefer data extractions, analytics and sampling, than those tools demanding a strong background in statistics, mathematics, and AI, which is, why we also argue that, due to the nature of DMATTs, needing all these AI , Programming , and mathematics and or statistics related skills , auditors are likely to experience anxiety which may lead to resisting in using or adopting DMATTs.

We argue that DMATTs concepts and techniques maybe new to a vast majority of public sector auditors, thus generates a sense of difficulty .It is perceived that auditors may face difficulty to learn which may give rise to anxieties such as learning anxiety (Li and Huang,2020), Learning computer in general comes with some degree of anxiety (Rosen et al,1987) People with anxiety usually face problems in learning (Jenkins 2002). Different skill sets in programming would require learning; therefore, auditors may experience anxiety when learning how to program in DMATTs.

Despite the great uses of data mining and analytics tools and techniques, the process of mastering these tools may result in anxiety. In a nutshell for DMATTs to be applied ,one need a tool and the required skills, that is software, for example   that is a text   programming

language(e.g. R, Python, Java) [43] or a Visual programming software [44] (e.g. AutoML,WEKA,KNIME,SPSS).Essential mathematics or needed mathematics and statistical knowledge to at least understand and interpret, the output and also to be able to choose the right algorithm for the right task(Wang et al, 2009).

These are skills requirements born by the very nature(features) of data mining and analytics, interacting with these features maybe a source of resistance or they may be threat-triggering to an existing status quo(that is a particular job description and content)(Lapointe and Rivard 2005). The feature of a technology has been found to be a key factor affecting usage decisions(Berente et al. 2011; Griffith 1999; Orlikowski and Gash 1994).

The implementation of a new information system is not always an easy task, technical and social changes requirements such as efforts required in learning new skills, business process redesign, change in task in some cases changes in the organizational structure (Kim,2011), and other changes induced by new IT system leads to anxieties. Anxiety in the adoption process is often seen as an inhibitor of adoption (Wang and Wang,2022).

Since data mining techniques and methodologies are built upon strong mathematical and statistical foundations, to really tap into the potentials of DMATTs, a certain level of mathematics and statistics may be required, algorithms in data mining are founded upon statistical and mathematical principles (Liane Colonna 2017), In summary quantitative thinking, statistical and mathematical literacy and interpretations are required for a successful and effective use of data mining and analytics.

We also argue the practice of data mining and analytics which requires certain vital skills that are not aligned with most SAI's educational background or training may trigger anxieties in individuals (SAI's) related to these skills. Data mining to an extent requires programming skills math and statistical skills, although today we do have non-programming data mining and analytical solutions or software (e.g. Auto_Weka,Azure_ML Studio,RapidMiner,KNIME), Data mining analytics done using programming is still highly sought after and considered as industry standard.

Data mining methods are also computationally intensive (Chen et al.,2000) and require skills such as determining how many patterns discovered by an algorithm are *"real, how to make probability statements about them and how many of them are non-trivial, interesting and valuable"* (Hand , 1998), they are not only very important but statistics related and or based on statistical criterion(Klosgen 1995).

Fayyad and Stolorz (1997) define data mining "*as a step in the KDD process that consist of applying data analysis and discovering algorithms that under acceptable computational efficiency limitations, produce a particular enumeration of patterns over the data"*. This is done using graphical user interface tools or visual programming languages (Orang ,WEKA,KNIME,IBM SPSS)(Hossain and Sardo 2020), ADAM(Rushing et

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[43] "Relational data mining has its roots in inductive logic programming, an area in the intersection of machine learning and programming languages". see Heikki Mannila – 2001 book: Relational Data mining springer 2001).

[44] Visual programming VPLs,"consist of a system in which icons,symbols charts and forms are used to specify a programm" (Navarro-Prieto and Cañas 2001) also see (Johnston, Hanna, and Millar 2004; Kuhail et al. 2021; Rekers and Schürr 1997).

al.,2006),D2K(Llora 2006),KNIME(Borthold et al,2006), mining Mart(Morik and Scholz 2004), Orangr(Demser and Zupan),Tangara(Rokotomalala 2005),Weka(Witten and Frank 2005),KEEL(Alcala-Fdez et al 2009), RapidMiner (formerly YALE)(Mierswa et al , 2006),and text programming such as python, R , Java etc. Learners usually experience anxiety when encountering these tools for the first time.

Prior researchers have tested the relationship between anxiety and the elements of the original TAM, such as perceived ease of use , perceived usefulness and found that , anxiety negatively affects perceived ease of use   and perceived usefulness (Igbaria 1993; Igbaria and Chakrabarti 1990; McFarland and Hamilton 2006; Tsai et al. 2019b), perceived ease of use(McFarland and Hamilton 2006; Tsai et al. 2019b),attitude and behavioural intention(Igbaria 1993; Lu and Su 2009)

Also researchers have previously looked at the relationship between anxiety and resistance to change(Guo et al. 2013; Liu et al. 2022),they found that anxiety positively relates to resistance to change. Based on the above we propose the following hypothesis:

H7a   DMATTs anxiety is negatively associated with Perceived ease of use.

H7b   DMATTs anxiety is negatively associated with perceived usefulness.

H7c   DMATTs is positively associated with Resistance to change.

H7d   DMATTs anxiety is negatively associated with user's attitude towards DMATTs.

H7e   DMATTs anxiety is negatively associated with users' behavioral intention to use DMATTs.

3.2.5. Programing Anxiety

Novices in programming are required to learn about logic, program syntax(scripting), forming of algorithms to solve problems (Bosch and D'mello 2017), Being in-experience and lack of the right background in programing may lead to or result in negative feeling and anxiety (Garner 2002, Gomes and Mendes,2007).This alone may be a source of programing phobia(anxiety), which when severe may lead to non-acquisition of the programming skills they intended to or required by the task they plan to do. (Chang 2005, Connolly et al, 2007).

Research especially in education, using students as case study, has found programing anxiety to impact students' ability to gain programming skills and even affect their future career choices (Connolly et al,2008, Nolan and Bergin, 2016).

We got inspired by educational related research since non-programing background auditors or anyone without programing skills needs to 'learn' programming in order to gain the required programming skills. The aspect of learning supports our treatment of SAI's requiring programing skills as "students" in this case.

Programming by nature requires very high levels of abstraction with intensive efforts (Rogerson and Scott 2010). which can be a great source of anxiety, learning to program requires learning a new way of thinking and studying. The newness can impede leaners success in programming (Rogers and Scott,2010).

Mathematical abilities have been proven to be a strong predictor of programing ability (Owalabi et al, 2014), "Mathematical anxiety can arise and overlap with programing anxiety" (Forrester et al,2022). When mathematical and statistical task are to be performed through programming or a programing language, This relationship is very important, since programing for data science and analysis is different from building a website. Programing here is playing the role of "automating" the mathematics and statistics, in data mining through the use of algorithms, thus if one requires to understand what he is programing, then it's fair to say even at "face value" understanding of mathematics and statistics and related data mining algorithms or techniques are necessary. Coding in data science and data mining is greatly intertwined with the understanding of data mining techniques.

Based on a previous literature on programming and mathematical anxiety Nolan and Bergin (2016), concluded that there is a relationship between mathematical anxiety and learning programing. Most computer science related concepts do have their roots and foundation in mathematics, its necessary to have at least the minimum required for the task you are interested in (Nolan and Bergin 2016).

Mathematical/statistical symbols and notations found in data mining and analytics methods such as Neural Network, regression, are often a source of anxiety as they usually portray difficulty in the eyes of those unfamiliar with such symbols, it's like a new language to be studied (Fone,2001)

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Although programming or learning to program may be so beneficial in an auditor's journey of effectively applying data mining and analytics, anxiety resulting from learning to program, may present a hinderance to the adoption of DMATTs (Connoly et al.,2008).

Prior research asserts that, programming background (Buderson and Christensen ,1995), quantitative and mathematical skills (Butcher and Muth,1985), programming self-efficacy (Ramalingnam and Wiedenbeck,1998) and anxiety can significantly affect, a learner's success in programming.

Since Most SAIs may lack a computer science background, it is possible that the large majority of them are novices when it comes to programming. Novices approaching programming for the first time usually suffer from programming induced anxiety, this is so because, programming involves concepts and materials that are unfamiliar and are "radically novel" (Scott, 2015), and abstract to them (Conolly et al.,2007). Even those with little expertise in computer science and math may find it difficult (Zupan and Demsar 2008). The very nature of programming, discrete (Conforth et al., 2014) (abstract, unfamiliar to novices), complex (Robinson et al.,2003), difficult to learn (Jenkins 2002), may evoke intense unease leading to "programming trauma" (Huggard 2004), such, un-easing feeling may include: confusion, frustration and boredom (Bosch et al.,2003)

Learning programming anxiety has been found to increase when first introduced to programming jargons, concepts, and principles (Campbell 2018). These concepts due to their unfamiliar nature (anxiety inducing nature), lead to leaners total avoidance of programming related activities (Olipas et al.,2021).

Moderate statistical analysis, which is intertwined with data mining is greatly dependent on the use of programming languages and tools (Donoghue et al.,2020), This is true as many algorithms and tools are implemented using programming languages such as R, Python, Julia (Custer et al.,2021), This also has been found to induce anxiety when learners attempt to gain programming skills (Beilock et al.,2010) to implement statistics. Dohono (2017), assets that proficiency in one or more data analytical languages(R, Python), and other languages relating to data extraction/query(SQL, NSQL)(Virmani ,1996), data transformation and manipulation are so vital, not leaving out languages for workflow management and collaboration(Version control languages such as git,github)(Donogue et al.,2020), web scraping data(Dogucu et al.,2021) result reproducibility packages(R Markdown)(Cetinkaya_rundel and Ellison,2021).

The fundamental stages of data mining and analytics that is data acquisition and wrangling, exploratory data analysis, data visualization, inferencing, modeling, and communication of results, are all perfectly executed using a programming language(syntax)(Cetinkaya-Rubdel and Ellison 2021). Programming itself is a skill difficult to acquire (de Souza.,2019), With a steep learning curve (Jovic et al.,2014),

ACCA[45] (2021), survey result of 992 ACCA members level of coding knowledge, shows that only 9% of that survey population are equipped with advanced programming that can actually be applied in their day-to-day work. Despite the benefits of programming skills such as better understanding of data, eases of communication with data scientists and other experts (ACCA,2021), accountants turn to resist learning coding, and some of the reasons include, fear, effort and time needed, self-perceptions of not being proficient in mathematics and computational related skills, programming not being a generic skill for accounting profession or their training lacks programming conceptual skills. Based on the above we present the following hypothesis:

H8a   Programming anxiety is positively associated with DMATTs anxiety.

H8b   Programming anxiety is positively associated with statistical anxiety.

3.2.6. Statistical/mathematics anxiety

Mathematics anxiety has been defined as" the feeling of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide variety of ordinary life and academic setting" (Richardson and Suim 1972). Prior research has found an association between mathematics avoidance behavior such as avoiding task and careers involving mathematics (Adams and Holcomb,1986; Cooper and Robinson.,1989). Research shows that individuals with mathematical anxiety usually avoid mathematics related situations and training (Akinsola et al.,2017).

Similar to mathematics anxiety, statistical anxiety can be understood as "the feeling of anxiety encountered when taking a statistical course or doing a statistical analysis" (Cruise et al.,1985), this construct has been well studied in educational psychology related research. Most of the

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[45] Association of Chartered Certified Accountants(ACCA), https://www.accaglobal.com/us/en/about-us/work-for-us/what-acca-does.html

time it looks at students' anxiety when studying statistics, in the statistics is indispensable in data analytics and mining (Lee and Siou,2001)

H9   Statistical anxiety increases DMATTs anxiety.

3.2.7. Sunk Cost

Sunk cost can be very instrumental in explaining users adoption decisions(Åstebro 2004). With respect to status quo bias perspective, individuals do not want to forgo previous investments cost in the status quo(that is incumbent system), thus they are likely to resist adopting a new system(Kim and Kankanhalli 2009).Sunk cost are retrospective cost incurred without the possibility to be recovered, as such if an individual perceived less benefits(that is , less gains from alternative when compared to the irrecoverable cost of the status quo subtracted) in the alternative , they may be reluctant to switch to it.

Prior information system researchers have investigated this construct with respect to resistance to change behaviours(Hsieh 2015; Kim 2011; Oschinsky et al. 2021) ,and user attitude (Tsai et al. 2019b). Tsai et al. (2019) findings supports a negative relationship between sunk cost and attitude toward change, while with respect to resistance to change in IS related research, a positive relation between sunk cost and resistance was confirmed , that is the higher the sunk cost the higher the probability for an individual to resist changing from the status quo to the alternative(Balakrishnan et al. 2021; Kim 2011; Oschinsky et al. 2021).

H10a   Sunk cost is negatively associated with user's attitude towards DMATTs.

H10b   Sunk cost is positively associated with Users Resistance to use DMATTs.

3.2.8. *Transition*

Transition cost is considered to be a subtype of switching cost (Samuelson and Zeckhauser 1988a),basically it consist of expenditures in terms of time and effort required in switching from the status quo. Burnham, Frels, and Mahajan (2003) categorised this as a procedural switching cost. New tools such as DMATTs may require substantial amount of time and effort to learn and gain skills enough to effectively apply it in audits. Transient expenses and permanent losses resulting from change makes up the components of switching cost(Kim and Kankanhalli 2009).Prior researcher have pointed out some caused of increase transition cost .For example , some found the loss of power , or status (DeSanctis and Courtney 1983; Jiang, Muhanna, and Klein 2000; Joshi 1991; Krovi 1993; Lapointe and Rivard 2005; Markus 1983),changes in job content(DeSanctis and Courtney 1983; Jiang et al. 2000; Krovi 1993), in some cases, it may be caused by , poor system quality (Hirschheim and Newman 1988; Markus 1983; Martinko, Henry, and Zmud 1996).

The higher this costs , the more likely the reluctance to change from the status quo for the sake of cost reduction(Kahneman and Tversky 1979) .Transition cost have been found to negatively affect attitude towards change(Tsai et al. 2019),and it positively influences resistance to change (Oschinsky et al. 2021). Based on these arguments, the following hypothesis is proposed.

H11a   Transition cost is negatively associated with users' attitude towards DMATTs.

H11b   Transition Cost is positively associated with resistance to change.

3.2.9.   Attitude

The original TAM postulates that, user's attitude which may be favourable or unfavourable (Taylor and Todd 1995),affects their behavioural intention to adopt and use a new system(Davis 1989) .Davis et al. (1989)posited that all things being equal "people form intentions to perform behaviours which they have positive affect". Prior studies have presented a strong positive relationship between attitude and behavioural intention(Chau and Hu 2001; Davis et al. 1989a; Hsu and Lu 2004; Taylor and Todd 1995; Tsai et al. 2019b)

H12   Users attitude towards DMATTs is positively associated to user's behavioral intention to use DMATTs.

Our hypothesis are summarized in Appendix C, while in figure 1, we present a pictural summary of our hypothesis and their various paths and relationships.
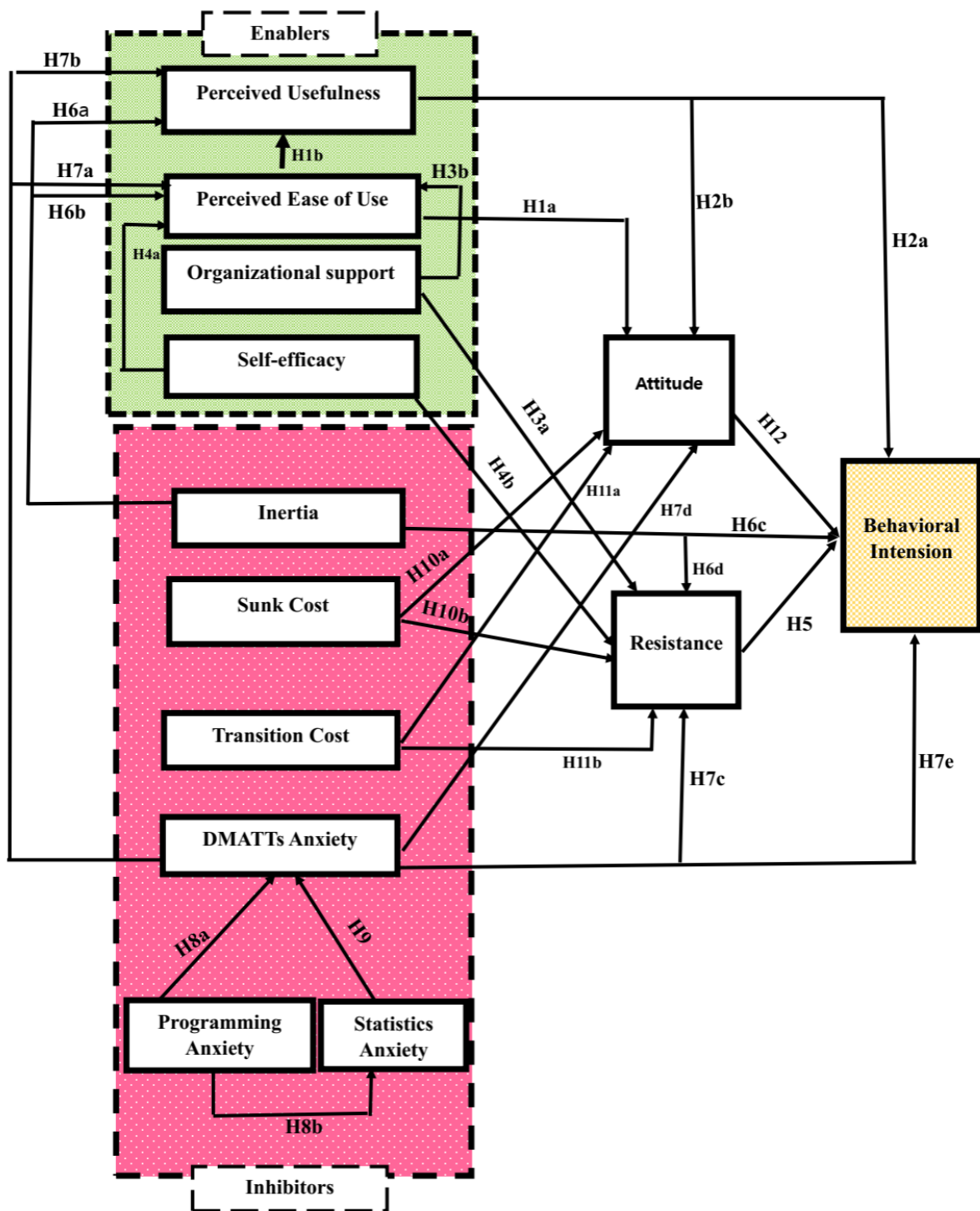
Figure.1. The proposed research model and hypothesis

4.   Research methodology

This study's constructs and model was inspired by the TAM model for enabling factors and, the combination of the status Quo Bias theory, with technology anxiety for the inhibiting factors. This dual factor approach is gaining momentum in IS research (Cenfetelli 2004; Tsai et al. 2019b) ,See fig1, the detailed model and research framework guiding this study.

For the development of the measurement instrument of this study, existing validated scales and empirical procedures were adopted as much as possible with slight customizations to fit the context of this work. Measurement scales used in this research and their sources are presented in Appendix D.   We adopted a 5-point Likert scale, anchored by strongly disagree to strongly agree. However, during coding some questions used a reverse scale, that is strongly agree which is normally is 5, in a 5-point Likert-scale when reversed scaled becomes 1. The research questions where of a professional nature requiring respondents to have at least an awareness of what DMATTs are and what they are used for, for these reasons the study targeted SAIs organizations with a history of using analytics in their audits. This was confirmed by reading audit reports from such organizations. The reason for targeting this population is because SAIs especially in developing countries are still yet to implement these sophisticated tools, using advanced SAIs as our research target, one can know their experiences during adoption and thus will serve as a guide for future adopters especially those in less developed nations.

For ease of use and convenience and web-based survey using google forms was used, this survey after several pilots, and testing, could be completed in 15 minutes. To get to our targets, we searched from each SAI's website, contacted the main secretariat in some cases where we could find staff directory on their websites. We contacted them directly with an email containing the questionnaire link. Since we are in the age of social media, popular sites such as Twitter and LinkedIn were also used, to recruit more respondents.

In some cases, the snow balling approach was used, requesting key individuals in the SAI community on Data analytics to help share the survey link. The bulk of our respondents were contacted through direct emailing, this was confirmed when emails are sent in their numbers you could see a tremendous increase in the number of responses that day. Since we couldn't ascertain the number of supreme auditors in each audit institution, getting a precise target or sampling was difficult, thus leading to the adoption of random sampling.

Due to the nature of constructs that is latent variables, this research adopts the Partial Least square structural equation modelling approach(PLS SEM)(Lee et al. 2011). One of the reasons for choosing PLS SEM, is its forgiving nature when it comes to sample size, unlike the covariance-based SEM, that requires having just the right sample size, not too small nor too large. When too small convergence may not occur thus affects the results. When too large, it may induce bias into the goodness of fit statistics requiring further interpretation, these are no issues in PLS SEM , since PLS SEM examines the variance explained in the data (Joseph F, Hair Jr. G. Tomas, M. Hult .Christian M., Ringle . Marko Sarstedt . Nicholas P 2022; Lee et al. 2011).

In general, structural equation model have an edge over multiple regression or it's extensions in that, complex chains of relationships , involving mediating variables or interfering variables

are difficult to be estimated simultaneously using regression models, Since by nature they are more efficient when such a model is broken down and calculated piece by piece, which may greatly affect the quality of the results obtained(Nitzl 2016). Also regression type models are less efficient when dealing with concepts which are "abstract, with non-observable properties or attributes of a social unit of entity"(Bagozzi and Phillips 1982). SEM is power in handling simultaneously complex model relationships ,and takes care of measurement error inherent in their indicators (Hair et al. 2019).

5. Data analysis and results

5.1. Descriptive statistics

Our Table 1 shows the demographic distribution of respondents, with respect to the affiliation of the SAI organization, a large majority of respondents that is 56.60% were from EUROSAI, the umbrella organization for European Supreme state Audit institutions, followed far behind by SAIs from OLACEF (the South American counterpart). The least represented was AFROSAI and CAROSAI with 0.5% and 1% respectively.

Most of the subjects were male, representing 57.80% of the sample, while females made up the rest 42.2% of the 206 total respondents. Most subjects were holders of a bachelor's degree that is 53.90%, followed by master's degree holders at 37.90%, and at the bottom PhD holders making up 8.30%.

It was also interesting to look at the educational background, since is gives a professional a different orientation on how to approach issues, especially in audits. Educational background was important because, some like those with a Science and or Engineering background are more likely to be verse with programming software than a humanities major. The results were dominated by subjects from the economics and Business area (57%), followed by social science (43.70%) and humanities (38.80%) with the sciences at the bottom accounting for 8 percent.

Two age brackets were predominant, that is 31 to 40 years and 41 to 50 years, accounting for 28.20% and 27.20% respectively, the youngest group that is less than 25years, were the least represented in the sample accounting for just 6.30%.

With respect to work experience as a public sector auditor, two groups were predominant, those that have work experience between 6 to 10years (27.7%) and those with experience between 11-15 year (24.48%). Most of the subjects attested to have used DMATTs, that is 69.90%, while those who say no also attest to have been in an audit team where DMATTs was used, this group accounting for 28.20%.

Another key Issue specific to this study is that of auditor type, most of the subjects are specialized in performance audit that is 59.20% 0f the sample, financial auditors made up 39.8%, while a handful identify as compliance auditors (8.3%). Most respondents attached their skills gaining to be from self-study, 75.70%, closely followed by in-house capacity building courses at 73,30%, and at the bottom 16% have not had any kind of DMATTs training. Expertise level was also investigated, most subjects are of advanced proficiency that is 34%, followed by Experts in DMATTs (17.50%), all of our respondents, have had some degree of

exposure or awareness about DMATTs. We also collected data on the types of data mining and analytics tools and techniques that have been used by auditors see, appendix A1 and 2.

We analyzed our data using SmartPLS 4 (Hair et al. 2021a) in two stages, representing the measurement model and the structural model. These partial least squares (PLS) regressions can simultaneously test multiple relationships among several dependent and independent variables. The SmartPLS program provides path coefficients, t-values, and *p*-values for each relationship, obtained from bootstrapping with resampling (5000 resamples). In addition, SmartPLS indicates the R-squared values for any endogenous variable in the model. The PLS method is appropriate method for validating exploratory multipath models with latent variables (Hair, Sarstedt, et al. 2012). Moreover, it provides the capacity to use smaller data samples without requiring a normal distribution of the data; the sample size (N = 206) for our study meets the common standards for PLS modeling (Hair, Sarstedt, et al. 2012).

Table 1: Descriptive statistics of Respondents

Measure	Item	Frequency	Percentage (%)
Regional Affiliations	EUROSAI	117	56.60%
	OLACEFS	21	10.20%
	ASOSAI	19	9.20%
	GAO	18	8.70%
	CAAF	16	7.80%
	PASAI	6	2.90%
	ARABOSAI	6	2.90%
	CAROSAI	2	1%
	AFROSAI	1	0.50%
Gender	Male	119	57.80%
	Female	87	42.20%
Education	Bachelors	111	53.90%
	Masters	78	37.90%
	Doctorate	17	8.30%
Educational Background	Social Sciences	90	43.70%
	Humanities	80	38.80%
	Economics and Business	118	57.30%
	Engineering	22	10.70%
	Sciences	8	3.90%
Age	less than 25 years	13	6.30%
	25-30 years	37	18%
	31-40 years	58	28.20%
	41-50years	56	27.20%

	51 years and above	42	20.40%
Work Experience	0-5 years	37	18%
	6- 10 years	57	27.70%
	11 -15 years	51	24.80%
	16 - 20 years	36	17.50%
	21 years and above	25	12.10%
DMATS Usage			
	Yes	144	69.90%
	No	4	1.90%
	No, but a colleague of mine/audit team member have used it in an audit that in was involved in	58	28.20%
Auditor Specialization	Financial Audits	82	39.80%
	Performance Audits	122	59.20%
	Compliance Audits	17	8.30%
DMATTS Training	General courses at a university or College	47	22.80%
	Online training seminars or LMS courses	141	68.40%
	in-house organizational courses	151	73.30%
	self-study	156	75.70%
	None	34	16.50%
DMATTs skill Level	Expert (recognized authority)	36	17.50%
	Advanced /Proficient (applied theory)	70	34%
	Competent /intermediate (practical application)	34	16.50%
	Advanced Beginner (limited experience)	26	12.60%
	No awareness	0	0.00%
Total		206(100%)	

5.2. Measurement model

According to (Hair et al. 2021a; Hair, Ringle, and Sarstedt 2012a) , the evaluation of a reflective measurement model; commences with examining the extent to which each indicator's variance is explained by its constructs, in other words assessing the indicator loadings reliability. Based on the indicator variance , we can verify the indicator reliability .Hair Jr et al. (2021) and Hair, Ringle, and Sarstedt (2012b),proposed an indicator loading equal to or above 0.708(≥0.708) as a recommended threshold to attain indicator reliability.

As per Appendix B, all the item cross loadings were above the threshold of 0.708 (Hair et al. 2021c), with the exception of DA4(0.681),DA5(0.566),DA10(0.431), and PA4(0.693). Although Hair et al. (2021c),proposed the removal of loadings between 0.40 and 0.708, they also cautioned, that rather than automatically deleting an item, an examination whether the elimination of such items will improve the internal consistency reliability or convergent reliability. Since all our below the threshold (0.708) items, were not less than 0.40,we had to reconsider a review to avoid outright elimination(Hair et al. 2021c).

We conducted a repetitive exercise of eliminating each of those items in the threshold of 0.40 to 0.708, to see if their elimination improves the convergent reliability, after a couple of rounds we did not find any substantial improvements in the convergent reliability thus retaining all the items(Hair et al. 2021c).

The next step was to measure the internal consistency reliability, which looks at the extent to which, items measuring the same constructs are related. As argued by Hair et al. (2021b),that even though Jöreskog (1971) proposed the composite reliability Rho , adopting the Rho_A , is preferable , simply for its strength over the Rho(Dijkstra 2014; Dijkstra and Henseler 2015) and the Cronbach alpha which assumes the same reliability as threshold(CR>0.7 and CA >0.7) was also adopted. Table 2, shows that our scales were all within the acceptable threshold, supporting internal consistency reliability.

Going by step 3 of Hair et al. (2021c)reflective model assessment procedure , we assessed the convergent validity of each constructs .In convergent validity assessment we examine the degree to which constructs converges to explain the variances of its indicators. Convergent validity can be evaluated using the average variance extracted(AVE).It is obtained by dividing the sum of squared loadings by the number of indicators .The minimum acceptable threshold is 0.50(Hair et al. 2021c).As per **table 2,** all our AVEs were above the 0.50 threshold , confirming convergent validity was attained.

According to Hair et al. (2021c) the final step in evaluating a reflective measurement model is the assessment of discriminant validity. It measures empirically, how a construct is distinct from other constructs in the structural model (Hair et al. 2021c). Two of the most widely used discriminant validity criteria are the Fornell-Larckercriterion (Fornell and Larcker 1981), and the heterotrait-monotrait ratio of correlations (HTMT) proposed by (Henseler, Ringle, and Sarstedt 2015).

Table 2: Composite Reliability and Convergent Validity

	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
ATT	0.954	0.954	0.879
BI	0.968	0.969	0.888
DA	0.949	0.960	0.635
INT	0.959	0.960	0.924
OS	0.931	0.932	0.783
PA	0.911	0.928	0.663
PEOU	0.972	0.972	0.922
PU	0.974	0.975	0.928
RTC	0.971	0.972	0.897
SA	0.973	0.973	0.901
SC	0.941	0.947	0.894
SE	0.948	0.948	0.906
TC	0.958	0.960	0.923

Due to the weaknesses of the Fornell-Larcker criterion of failing to identify discriminant validity problems(Radomir and Moisescu 2020)., we adopted the recommended alternative of HTMT (Hair et al. 2021c). Henseler et al. (2015) proposed a <0.85 threshold for conceptually distinct constructs and <0.90 for conceptually similar constructs. Based on **Table 3**, all our constructs where below the 0.90 threshold, conforming the attainment of discriminant validity.

Table 3: Discriminant Validity -Heterotrait-monotrait ratio (HTMT) Matrix

	ATT	BI	DA	INT	OS	PA	PEOU	PU	RTC	SA	SC	SE	TC
ATT													
BI	0.829												
DA	0.897	0.881											
INT	0.690	0.705	0.751										
OS	0.719	0.757	0.687	0.590									
PA	0.892	0.723	0.549	0.798	0.767								
PEOU	0.853	0.891	0.883	0.755	0.833	0.831							
PU	0.819	0.729	0.884	0.711	0.802	0.807	0.890						
RTC	0.836	0.860	0.639	0.703	0.642	0.884	0.792	0.810					
SA	0.821	0.847	0.806	0.671	0.641	0.858	0.796	0.807	0.896				
SC	0.615	0.607	0.576	0.556	0.580	0.639	0.616	0.633	0.486	0.450			
SE	0.858	0.709	0.814	0.710	0.791	0.894	0.702	0.873	0.844	0.826	0.587		
TC	0.645	0.632	0.625	0.592	0.545	0.669	0.643	0.646	0.558	0.548	0.822	0.643	

Table 4: R-Square of the Model and Prediction relevance (Q²)

Endogenous Variables	R-square	R-square adjusted	Q^2predict
ATT	0.801	0.798	0.718
BI	0.849	0.847	0.775
DA	0.857	0.856	0.791
PEOU	0.851	0.849	0.85
PU	0.799	0.797	0.783
RTC	0.809	0.805	0.712
SA	0.658	0.657	0.653

Notes: R-square denotes the explanatory power of the model; R-square Adjusted is the adjusted value of R2; Q^2 represents the predictive relevance of the model.

5.3. Structural Model

Our structural model was examined by assessing the significance of the path coefficient, the coefficient of determination R^2 of the endogenous constructs, and the predictive relevance of our model (Q^2-value)(Hair et al. 2021d).

The R^2 coefficient measures the explanatory power of a model by explaining the variance in each of the endogenous constructs. According to Hair et al. (2021), R^2 values of 0.75,0.50,and 0.25 are considered substantial , moderate and weak respectively.

Table 4 contains our R^2 values. As per the results, all our endogenous variables were substantially explained by their exogenous variables. The predictors explained 80% of ATT,84.9% of BI and 80.9% of RTC. That is, the predictors of PA and SA explained 85.7% of DA.In the case of RTC , 80.9% of the variance was explained for by DA,SA,TC,INT,SE,OS, and ,85.1% variance in PEOU was accounted for by DA,IN,SE,OS, with respect to PU's 79.9% was explained by PEOU,DA,INT. ATT's 80.1% was explained by PU,PEOU,DA,SC,TC. The constructs, DA, PU, ATT, RTC and INT explained 84.9% of the variance in BI and finally PA explained 65.8% of the variance in SA. In summary all our endogenous variables were substantially explained by their exogenous constructs except for SA which was moderately explained.

We also examined the model's predictive relevance(out-sample) of our endogenous constructs using the stone-Geisser Q^2. The basic criteria for predictive relevance to be attained states that, a Q^2 value should be above zero (0).Hair et al. (2021d) proposed a more detailed threshold of $0.02 < Q^2 < 0.15$ to be weak predictive relevance ,$0.15 < Q^2 < 0.35$ to be moderate predictive relevance and $Q^2 > 0.35$ to represent a strong predictive relevance, hence based on our results in table 4,all our constructs had a strong predictive relevance.

5.4. Hypothesis

The significance and magnitude of the path coefficients were evaluated using the PLS bootstrapping procedure with 5000 subsamples(Joseph F, Hair Jr. G. Tomas, M. Hult .Christian M., Ringle . Marko Sarstedt . Nicholas P 2022)

Table 5 shows the overall model, the different hypotheses.From the table we can see each hypothetical relationship and their levels of significance. H1a was not supported, meaning perceive ease of use had no influence on our respondents attitude towards DMATTs, however, H1b , showed a positive significant relationship between perceived ease of use and attitude (path coefficient=0.481***), on the other hand the second key TAM constructs perceived usefulness, had a positive significant influence on behavioral Intention(H2a:path coefficient=0.351***) and on attitude(H2b:path coefficient =0.518**).

With respect to the construct: Organizational support, only H3b (path coefficient=0.0305***) was supported, meaning organizational support had a positive impact on perceived ease of use. Implying more support given by management makes auditors become familiar and see the tool to be easy to use.

Self-efficacy measured in H4a and H4b, just a H4a (path coefficient=0.248***) was significant, that is self-efficacy positively associated with perceived ease of use.

H5(path coefficient=-0.148*), representing a very key relationship in this study, explaining that resistance to change negatively impacts user's behavioral intention.

The construct inertia was not very effective in this model , as almost all its hypotheses where not significant , the exception was H6b (path coefficient=-0.152**),which implies inertia had

a negative effect on users perceived ease of use , this is in line with the results of (Polites and Karahanna 2012).

One of the most interesting results which is key to this research is the DMATTs specific anxiety, all the DMATTs anxiety hypothesis (H7a to H7e) were significant, these findings are novel in that, it's the first-time data mining specific anxiety has been tested. Even programing (H8a and H8b) and statistics anxiety(H9) were all significant.

Meanwhile SQB factor items Sunk cost and transition cost, their related hypothesis performed poorly, none of which was significant to both the enable construct of attitude and the inhibiting construct of resistance to change. A pictural summary of our results are presented in **figure 2**.
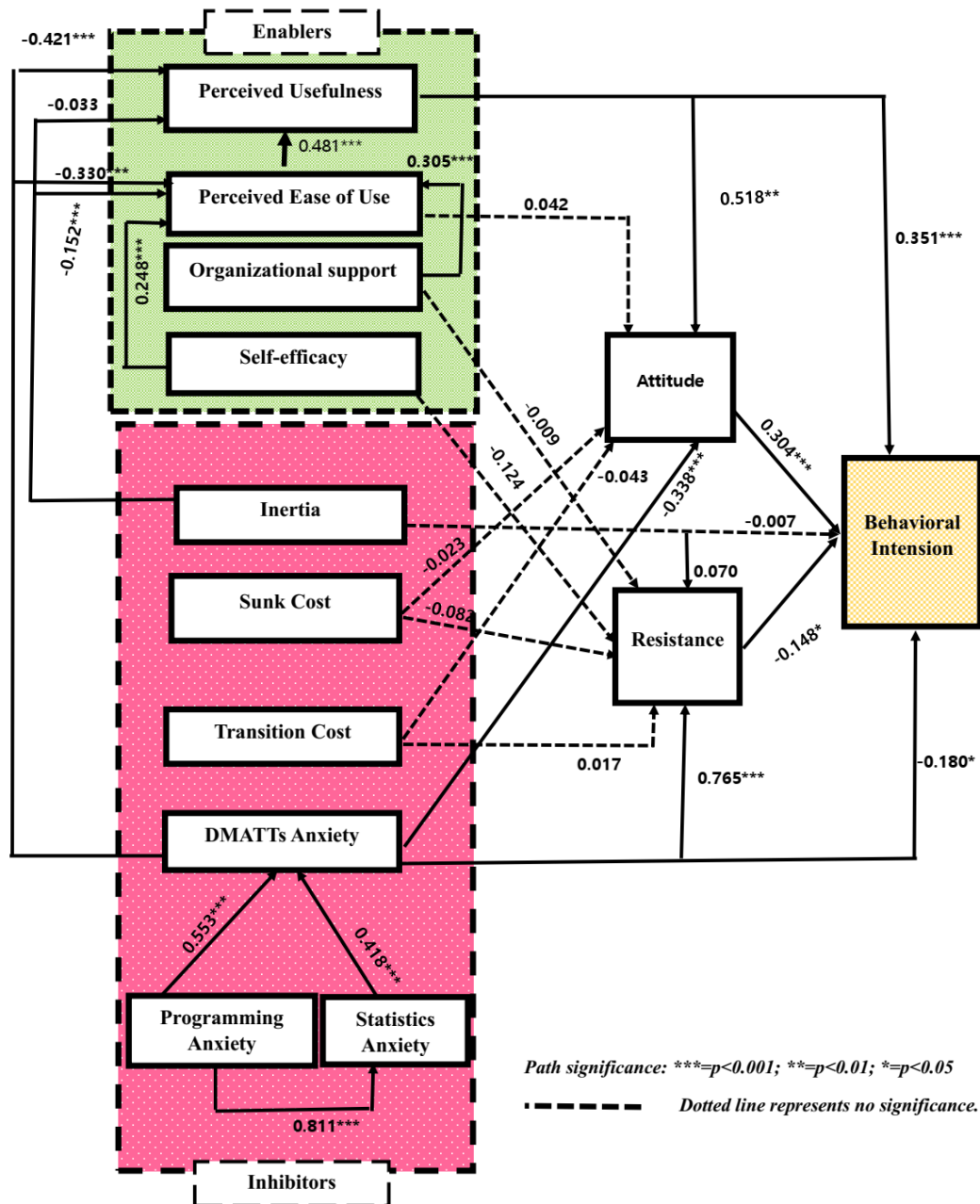
Figure.2. The results of the structural modeling analysis

Table 5: Path Coefficients-Standard deviation, T values, P values

Hypothesis		Expected Sign	Path Coefficients	Standard deviation	T statistics	P values	Supported?
H1a	**PEOU -> ATT**		**0.042**	**0.056**	**0.754**	**0.451**	**No**
H1b	PEOU -> PU		0.481***	0.082	5.892	0.000	Yes
H2a	PU -> BI		0.351***	0.081	4.343	0.000	Yes
H2b	PU -> ATT		0.518***	0.076	6.836	0.000	Yes
H3a	**OS -> RTC**		**-0.009**	**0.047**	**0.200**	**0.841**	**No**
H3b	OS -> PEOU		0.305***	0.044	6.921	0.000	Yes
H4a	SE -> PEOU		0.248***	0.078	3.196	0.001	Yes
H4b	**SE -> RTC**		**-0.124**	**0.080**	**1.553**	**0.121**	**No**
H5	RTC -> BI		-0.148*	0.069	2.138	0.033	Yes
H6a	**INT -> PU**		**-0.033**	**0.043**	**0.770**	**0.441**	**No**
H6b	INT -> PEOU		-0.152***	0.041	3.736	0.000	Yes
H6c	**INT -> BI**		**-0.007**	**0.036**	**0.209**	**0.834**	**No**
H6d	**INT -> RTC**		**0.070**	**0.049**	**1.434**	**0.152**	**No**
H7a	DA -> PEOU		-0.330***	0.072	4.609	0.000	Yes
H7b	DA -> PU		-0.421***	0.082	5.121	0.000	Yes
H7c	DA -> RTC		0.765***	0.073	10.466	0.000	Yes
H7d	DA -> ATT		-0.338***	0.071	4.729	0.000	Yes
H7e	DA -> BI		-0.180*	0.078	2.301	0.021	Yes
H8a	PA -> DA		0.553***	0.062	8.969	0.000	Yes
H8b	PA -> SA		0.811***	0.031	25.986	0.000	Yes
H9	SA -> DA		0.418***	0.060	6.996	0.000	Yes
H10a	**SC -> ATT**		**-0.023**	**0.048**	**0.480**	**0.631**	**No**
H10b	**SC -> RTC**		**-0.082**	**0.067**	**1.226**	**0.220**	**No**
H11a	**TC -> ATT**		**-0.043**	**0.047**	**0.919**	**0.358**	**No**
H11b	**TC -> RTC**		**0.017**	**0.072**	**0.233**	**0.816**	**No**
H12	ATT -> BI		0.304***	0.080	3.787	0.000	Yes

*p<0.05; **p<0.01; ***p<0.001

6.   Discussion of findings and implications

The current study contributes to the understanding of factors that may enable or inhibit an individual from adopting DMATTS, the salient findings are as follows:

Based on the results , technology specific anxiety , predicts adoption behavior, this is contrary to the case of Huang et al. (2012) where they included the general computer anxiety construct in their model, they discovered that computer anxiety is no more effective as a construct predicting adoption behaviors because, today every office worker uses a computer, especially in the developed world , thus we concluded that general computer anxiety or technology anxiety may not well explain adoption behaviors. Our study, instead of following this path of repeating their approach, we coined out a data mining specific anxiety construct, which captures specific anxieties that may arise from an encounter with data mining and analytics. The end results confirmed this approach, with all the hypothesis relating to that construct emerging significant. With their exact predicted sign (positive or negative).

The other factors have been tested before and our results confirmed some while failed to confirm others, for example the hypothesis H6b, was significant , similar results were obtained in (Polites and Karahanna 2012). Also a non-significant example , that is sunk cost failed to impact attitudes (Tsai et al. 2019b), however we obtained a non-significant values for H11a,meaning Transaction Cost had no effect on attitude , this was contrary to (Tsai et al. 2019b), their result showed a very strong negative effect of Transition cost on attitude. We argue that, this might be explained by so many factors, including differences in the type of technology and demographic issues such as age, gender , educational background etc. .

Theoretical implications

Although our results did not show any strong relationship between the status quo bias constructs of sunk cost, transition cost and inertia on resistance and attitude towards change, we however, obtained novel findings contributing to the information system adoption research literature. We found that, information system specific or technology specific anxiety plays a great role in influencing an individual's adoption decision.

The emphasis on system-specific anxiety is due to the fact that previous researchers found no impact of anxiety on individuals adoption decision(Huang et al. 2012).We argue that by using computer anxiety or anxiety as a construct is too general, and over simplified, thus may not capture anxiety specific to the technology in question. For example, using a computer anxiety construct for excel or Microsoft word adoption may not capture the impact of DMATTs anxiety in DMATTs adoption. The simple reason being that today's auditors are so familiar with Microsoft tools, they're generic to their work life, it's normal to find an auditor proficient in excel or Microsoft word however this proficiency cannot easily be transferred to DMATTs, thus computer anxiety for excel may be different for DMATTs in terms of intensity and or severity on their adoption decision. Also, it's a fact that not everyone writes computer programs, but almost all auditors use Microsoft office tools for their day-to-day activities.

We argue that technology specific anxiety(in our case DMATTs specific anxieties),plays a key role in the dual factor approach (Cenfetelli 2004; Luftman, Papp, and Brier 1999)of

investigating information system adoption. That is, it directly affects resistance which is an inhibitor(Cenfetelli 2004), while with enablers it had a direct and indirect effect.

With respect to enablers , that is factors promoting adoption(Luftman et al. 1999) , DMATTs specific-anxiety , negatively affects the individuals attitude towards change , and their intention to change , meaning the higher the anxiety levels, individuals develop a more negative perception or belief and thus negatively affects their intention to use a new system.

Also anxiety negatively impacts enabling factors ;perceived ease of use and perceived usefulness proposed by TAM(Davis 1989), this negative impact has an indirect effect on users attitude and behavioural intention to use DMATTs. We concluded that, the higher the DMATTs specific anxiety , the lower the individuals perceived ease of use and perceived usefulness which are key TAM constructs enabling technology adoption.(Davis et al. 1989a).

With respect to inhibitors, DMATTs anxieties had both direct and indirect effects. That is, it directly increases resistance which in turn negatively affects intention to use DMATTs.

These results have demonstrated the importance of technology specific anxiety, therefore what are some of the sources of DMATTs specific anxieties? These anxieties are derived from the characteristics of DMATTs related skills needed in DMATTs operationalisation and or use, that is skills which gives an individual the understanding of methodologies and tools use in implementing DMATTs.

The effective application of DMATTs requires the convergence of 3 things, that is the methodologies in other words the techniques (for example algorithms), the tools through which the techniques are applied or operationalized(for example using a programming software like Python to implement a gradient descent algorithm), and the skilled individual who put everything together. If an individual's lacks knowledge in the methodology and tools , this convergence cannot take place and thus DMATTs cannot be operationalized or applied, thus unfamiliarity with the DMATTs is one of the sources decision making biases as per the status quo bias theory(Samuelson and Zeckhauser 1988a).

To be more specific, DMATTs requires some knowledge in statistics and or mathematics at least to know which algorithm or technique is right for a task and to be able to read and understand the output. A lack of statistics and or computational background may result in anxiety towards DMATTs.

Since the algorithms are operationalised through a software. That is programming the statistics to act on a data set to produce results. Programming automates the statistics and maths involve in Data mining and analytics. To be more emphatic, without a software it is practically impossible to apply Data mining and analytics. Skills in a DMATTs software is very essential, a lack of this may result in anxiety. Our results also made a finding that programming anxiety and statistical anxiety are non-recursive constructs. That is, to an extent they reciprocally affect each other.

In summary , the mixed findings about anxiety in the literature i.e. being significant (Tsai et al. 2019b) and not-significant(Huang et al. 2012) on technology adoption decision making may have been due to the over simplification and generalisation of the construct. Generalisation

here means, authors use it without in-depth considerations of the possible sources of anxiety specific to the technology in their research, thus we call on more research to try our approach of looking at technology specific anxiety. Acknowledging that the mixed results might have been caused by other factors such as demographics of their respondents , we argue that it is ineffective to use general computer anxiety as a construct today, this construct was developed in the early days of microcomputers (see Igbaria and Parasuraman 1989), today things have changed since we live in a technology intensive society.

Finally, with respect to accounting information System (AIS), we argue that, using the generic term CAATTs adoption may be less intuitive, CAATTs is an Umbrella term making it so vague, CATTs encompasses a spectrum and or plethora of tools and techniques which aids an auditor in performing audits. This can be from the most generic and easy such as Microsoft word to the most difficult and specialised such as Python: -Scikit-learn, NumPy , pandas etc,.

We bring in two new theoretical perspectives in AIS research: a) we adopted a specific CAATTs approach, that is looking at a specific tools and technique.2) we applied the dual factor approach in our analysis.

With our unique results obtained, we call on AIS researchers to be more specific, for example present the characteristics of a particular CAATTs, and from those characteristics derive a model that can capture the impact of these characteristics on an individual's adoption and use decision making.

Practical implications

This study results permits us to make the following recommendations to SAI organisations, to improve the adoption rate and reduce resistance by individual auditors. Before our recommendations we would like to stress that, the adoption or introduction of DMATTs in an organisation does not mean the absence of resistance. Resistance could be passive, and or non-visible, for example employers avoiding to use the new system or use it less, generally, resistance to change is considered one of the main sources of failure in change initiatives(Lawrence 1954; Maurer 1996; Strebel 1994; Waddell and Sohal 1998)

Based on our finding, we could see the negative role technology specific anxiety could play in promoting resistance to change. By looking at anxiety specific to DMATTs, we found that DMATTs related anxiety can reduce auditors' positive attitude towards DMATTs and increase negative attitudes which is manifested through resistance behaviours.

Our findings raised the need for managements to device strategies to curb this anxiety. Based on that premise, we proposed the following practical solutions and implication.

We recommend that, before introducing DMATTs, considerations must be made with respect to the possibilities of resistance to occur, that is, the very nature of DMATTs may induce anxiety. This acknowledgement of possible anxiety induced resistance is considered the first and most critical step(Ben-Jacob and Liebman 2009). Usually in a company employees may not outrightly protest a new system being introduced, instead they may passively resist the new technology through actions such as non-use, or infrequent use. These passive

behaviours(Marakas and Homik 1996), may lead to poor implementation of DMATTs and to an extend affects productivity (Goodhue and Thompson 1995) of quality audit   reports.

Although we acknowledge that individuals may resist a new system based on personal reasons , research has shown that management cultures which do not promote a conducive environment for change may lead to resistance(Judson 1966; Lawrence 1954).

After acknowledging the potential existence of anxiety which may lead to resistance, management needs to devise strategies to reduce these DMATTs related anxieties. We recommend the following.

a) Management should encourage experimentation, (Deloitte 2016; Hoyne 2022; Kamouri, Kamouri, and Smith 1986), an environment where auditors can experiment these technologies , this environment can be in the form of experimental spaces(Bojovic, Sabatier, and Coblence 2020; Bucher and Langley 2016; Cartel, Boxenbaum, and Aggeri 2019; Wulf 2000), such as innovation labs(Bellefontaine 2012; Lewis and Moultrie 2005; Tõnurist, Kattel, and Lember 2017),sinceexperimentation is said to reduce anxiety.

b) Management should device capacity building activities in form of training support and DMATTs awareness. For example training has been proven to "cure" tech specific anxiety(Igbaria 1993; Jiang et al. 2000).In house training may be organised , staff may be introduced to self-paced training (Gupta 2017), which gives them relaxation in learning and thus reduce anxiety from learning DMATTs(a source for transition cost)(Manzoni et al. 2008) .In line with self-paced training , Online MOOCs (Feklistova, Lepp, and Luik 2021; Romero and Ventura 2017; Wen, Qualls, and Zeng 2020), are also a great way to gain skills in DMATTs with less anxiety. Today edtech companies such as Cousera, Edx, provides world class training on DMATTs. MOOCs also promote a very important anxiety reducing culture of continuous learning(Poquet et al. 2021), MOOCs are also in line with the recommendations of the finding of Maki et al. (2000) that online courses reduces computer related anxieties.

Management should also encourage peer to peer mentoring and coaching(Jones and Bayen 1998), that is staff with DMATTs skills should be leveraged in mentoring and helping novices.

Another type of capacity building activity of informing that is through awareness and advocacy activities, management can explain to auditors the purpose, potentials and overall benefits of using Data mining and analytics tools and techniques. Orientations events, explaining why the technology is important , not just to the organisation but to the auditors work, that is the relevance and benefits of DMATTS to an auditor must be clearly explained(Goldsborough 2007; Rutherfoord 2004).In general management should provide ways to reduces anxiety through   what Igbaria and Chakrabarti (1990) described   as management support is highly recommended. Apart from training management should be fully involved in the change process.

c) We also propose that instead of introducing data mining and analytics using programming intensive tools such as python, R, Java, management may start with visual programming languages and or tools such as WEKA, KNIME,H20 etc, using these

tools at the early stages of training, auditors will have more time focusing in the principles and algorithms of data mining and analytics, on the contrary when introduced to data mining and analytics using text or syntax programming intensive tools and or software such as python, Java, auditors will incur double anxiety that is anxiety from the algorithms and principles of data mining and analytics and anxiety from learning the jargons and principles of coding and scripting .

7.   Limitations, future research, and conclusion

This study uses the Dual factor approach incorporating constructs from TAM, SQB, and anxiety to investigate the factors affecting auditor's decision to use DMATTs, however, this study examines the behavioral intentions of a specific tool rather than general information technology in the field of AIS and MIS. Therefore, it may be difficult to generalize the findings of this study to other instrument-oriented technologies. Future research should investigate this phenomenon as it relates to other types of technologies. This study also investigates individual intentions to use DMATTs, which could help SAI managers make decisions or improve productivity. The research results would be more robust if we had investigated this model over time rather than at a point in time. Therefore, a longitudinal study could be conducted in future to obtain more comprehensive results. This study investigates factors at the individual level. However, there might be more intrinsic/extrinsic motivational factors as to why auditors would like to adopt DMATTs or not, such as the difficulties and challenges of finding hidden patterns in DM and the joy of discovering new ones. There might also be organizational factors, e.g., top management directives and mandates, that are not considered in this study. Scholars interested in this topic can extend this research model and increase its explanatory capabilities by adding other factors.

The findings of our study may be limited in that, the choice of constructs was based on literature review and our observations of how SAI's behave towards DMATTs. These observations were done during SAI's webinars and conferences. With focus on DMATTS and related technologies. However, there may be other important constructs that were not included in our study based on these potential biases resulting from our personal assessment from observations, so we call on researchers to look for other constructs which may capture resistance and adoption behaviours.

Our study is broadly classified under the area of organisational change, change which is usually motivated by the need to adapt to the current environment(Barr, Stimpert, and Huff 1992) or to improve performance and productivity(Boeker 1997; Keck and Tushman 1993).The disruptiveness of the current status quo , that is the advent of sophisticated digital technologies, has motivated us to investigate why there's a low rate of adoption of DMATTs by auditors , despite it having the potentials to drastically improve their performance and productivity.

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Appendix A1:

Data Mining and Analytics Tools	%*
Tableau	76.2
ACL	73.8
R (tidyverse,ggplot2 etc.)	71.3
Python (Scikit-learn,Numpy,pandas etc)	67.8
TeamMate	67.3
Rapid Miner	66.8
Microsoft Power BI	64.9
Interactive Data Extraction and Analysis (IDEA)	64.9
SAS enterprise Miner	63.9
SQL	58.4
Java	55.4
WEKA	48.5
Keras	48
SAS Enterprise Miner	45
Tensor Flow	45
H20	40.6
Perl	39.1
H20	37.6
Julia	36.6
Knime	35.1
Tanagra	33.2
Matlab	30.2
GNU octave	28.7
Looker	26.7
Klipfolio	26.2
Qlik Sense	23.3
Zoho Analytics	22.8

Note: These percentages represent the proportion of our total respondents who attest to have used a particular technique

Appendix A2:

Data mining and analytics Techniques used by SAI's	%*
Descriptive Statistics (e.g Mean, median, mode, standard deviation)	70.5
Clustering Models	67
Ratio Analysis	63.5
Spearman Rank Correlation	61.5
Visualization	59
Linear Regression	56.2
C4.5 Statistical Classifiers	54.7
Benford's Law	53.7
Log Regression	52.7
Bayesian Theory/Bayesian Belief Networks (BBN)	52.2
Bagging and Boosting models	50.7
Expert Systems/Decision Aids	50.7
Analytical Hierarchy Processes (AHP)	49.8
Auto Regressive Integrated Moving Average (ARIMA)	48.3
Time Series Regression	48.3
Support Vector Machine (SVM)	47.3
Artificial Neural Networks (ANN)	46.8
Multi-criteria Decision Aid	45.3
Process Mining: Process Optimizations	45.3
Hypothesis Evaluations	44.8
Structural Models	44.8
Probability Theory Models	44.3
Dempster-Shafer Theory Models	42.8
Genetic Algorithms	41.3
Monte Carlo Study/Simulation	41.3
Univariate and Multivariate Regression Analysis	41.3

Note: These percentages represent the proportion of our total respondents who attest to have used a particular technique

Appendix B:

Discriminant Validity -Cross Loadings

	ATT	BI	DA	INT	OS	PA	PEOU	PU	RTC	SA	SC	SE	TC
ATT1	**0.897**	0.814	-0.791	-0.657	0.700	-0.809	0.807	0.837	-0.727	-0.729	-0.553	0.772	-0.585
ATT2	**0.948**	0.843	-0.807	-0.597	0.614	-0.755	0.752	0.837	-0.768	-0.749	-0.551	0.759	-0.580
ATT3	**0.945**	0.842	-0.794	-0.610	0.581	-0.761	0.739	0.821	-0.762	-0.732	-0.548	0.750	-0.576
ATT4	**0.959**	0.848	-0.823	-0.611	0.644	-0.791	0.783	0.826	-0.761	-0.757	-0.542	0.777	-0.573
BI1	0.862	**0.925**	-0.848	-0.650	0.666	-0.820	0.817	0.830	-0.820	-0.779	-0.557	0.827	-0.589
BI2	0.837	**0.940**	-0.811	-0.628	0.685	-0.801	0.825	0.832	-0.765	-0.750	-0.547	0.807	-0.560
BI3	0.806	**0.943**	-0.810	-0.620	0.716	-0.828	0.828	0.831	-0.750	-0.742	-0.562	0.838	-0.575
BI4	0.855	**0.951**	-0.843	-0.669	0.666	-0.823	0.804	0.867	-0.809	-0.818	-0.553	0.815	-0.581
BI5	0.845	**0.952**	-0.827	-0.634	0.655	-0.816	0.797	0.859	-0.787	-0.784	-0.524	0.818	-0.562
DA1	-0.762	-0.819	**0.851**	0.673	-0.672	0.823	-0.794	-0.776	0.773	0.715	0.640	-0.800	0.620
DA10	-0.306	-0.305	**0.431**	0.265	-0.130	0.289	-0.270	-0.306	0.442	0.400	-0.049	-0.337	0.075
DA11	-0.711	-0.760	**0.885**	0.626	-0.528	0.778	-0.734	-0.703	0.791	0.765	0.451	-0.737	0.518
DA12	-0.711	-0.758	**0.881**	0.635	-0.525	0.777	-0.726	-0.693	0.776	0.760	0.463	-0.738	0.488
DA13	-0.725	-0.743	**0.873**	0.624	-0.541	0.762	-0.733	-0.698	0.757	0.733	0.461	-0.739	0.495
DA2	-0.791	-0.821	**0.897**	0.680	-0.658	0.847	-0.791	-0.807	0.801	0.777	0.589	-0.795	0.622
DA3	-0.781	-0.810	**0.883**	0.644	-0.606	0.819	-0.788	-0.766	0.821	0.748	0.528	-0.788	0.561
DA4	-0.619	-0.596	**0.681**	0.441	-0.440	0.575	-0.578	-0.577	0.590	0.611	0.313	-0.574	0.366
DA5	-0.493	-0.490	**0.566**	0.360	-0.230	0.462	-0.404	-0.445	0.609	0.572	0.259	-0.500	0.342
DA6	-0.680	-0.660	**0.774**	0.563	-0.560	0.706	-0.678	-0.698	0.667	0.684	0.441	-0.672	0.507
DA7	-0.764	-0.755	**0.878**	0.647	-0.643	0.817	-0.781	-0.785	0.741	0.736	0.468	-0.772	0.514
DA8	-0.689	-0.686	**0.804**	0.584	-0.488	0.681	-0.684	-0.710	0.683	0.714	0.457	-0.688	0.537
DA9	-0.691	-0.708	**0.801**	0.583	-0.581	0.688	-0.708	-0.731	0.736	0.687	0.442	-0.724	0.455
INT1	-0.608	-0.631	0.675	**0.951**	-0.548	0.701	-0.691	-0.636	0.621	0.604	0.473	-0.636	0.504

INT2	-0.641	-0.651	0.703	**0.968**	-0.525	0.729	-0.706	-0.670	0.657	0.631	0.518	-0.662	0.571
INT3	-0.654	-0.676	0.708	**0.964**	-0.533	0.726	-0.706	-0.677	0.677	0.635	0.539	-0.655	0.561
OS1	0.621	0.646	-0.589	-0.498	**0.893**	-0.620	0.712	0.703	-0.548	-0.547	-0.495	0.656	-0.476
OS2	0.564	0.615	-0.572	-0.489	**0.865**	-0.625	0.659	0.665	-0.520	-0.527	-0.491	0.622	-0.468
OS3	0.627	0.633	-0.549	-0.482	**0.884**	-0.587	0.685	0.687	-0.537	-0.554	-0.463	0.643	-0.445
OS4	0.608	0.635	-0.614	-0.487	**0.894**	-0.652	0.710	0.671	-0.542	-0.522	-0.499	0.672	-0.459
OS5	0.579	0.649	-0.601	-0.509	**0.889**	-0.639	0.739	0.651	-0.554	-0.551	-0.458	0.694	-0.425
PA1	-0.798	-0.823	0.851	0.698	-0.679	**0.903**	-0.829	-0.821	0.783	0.749	0.657	-0.798	0.687
PA2	-0.644	-0.633	0.608	0.460	-0.435	**0.610**	-0.545	-0.624	0.610	0.555	0.353	-0.535	0.354
PA3	-0.710	-0.747	0.709	0.658	-0.684	**0.795**	-0.768	-0.775	0.630	0.615	0.527	-0.696	0.548
PA4	-0.519	-0.536	0.570	0.454	-0.433	**0.693**	-0.535	-0.511	0.569	0.537	0.342	-0.509	0.368
PA5	-0.710	-0.758	0.827	0.643	-0.596	**0.905**	-0.771	-0.739	0.777	0.773	0.472	-0.744	0.550
PA6	-0.731	-0.771	0.824	0.701	-0.590	**0.934**	-0.787	-0.747	0.775	0.763	0.539	-0.764	0.559
PA7	-0.589	-0.632	0.634	0.599	-0.577	**0.807**	-0.715	-0.612	0.552	0.573	0.472	-0.646	0.466
PEOU1	0.788	0.834	-0.814	-0.708	0.766	-0.836	**0.954**	0.840	-0.740	-0.747	-0.588	0.828	-0.624
PEOU2	0.775	0.818	-0.821	-0.683	0.752	-0.825	**0.959**	0.816	-0.732	-0.730	-0.575	0.829	-0.581
PEOU3	0.799	0.841	-0.833	-0.706	0.765	-0.858	**0.964**	0.837	-0.745	-0.759	-0.559	0.841	-0.600
PEOU4	0.795	0.825	-0.829	-0.703	0.761	-0.852	**0.963**	0.832	-0.739	-0.736	-0.545	0.827	-0.578
PU1	0.879	0.880	-0.849	-0.684	0.744	-0.844	0.859	**0.969**	-0.774	-0.764	-0.603	0.815	-0.621
PU2	0.837	0.851	-0.812	-0.654	0.725	-0.817	0.818	**0.966**	-0.737	-0.733	-0.601	0.791	-0.599
PU3	0.838	0.860	-0.817	-0.670	0.740	-0.824	0.839	**0.955**	-0.767	-0.771	-0.573	0.821	-0.593
PU4	0.859	0.861	-0.824	-0.643	0.732	-0.811	0.819	**0.963**	-0.760	-0.761	-0.569	0.806	-0.592
RTC1	-0.743	-0.766	0.825	0.631	-0.580	0.792	-0.730	-0.725	**0.915**	0.784	0.443	-0.753	0.506
RTC2	-0.751	-0.774	0.850	0.621	-0.561	0.778	-0.717	-0.737	**0.959**	0.837	0.418	-0.769	0.479
RTC3	-0.769	-0.787	0.836	0.631	-0.576	0.780	-0.710	-0.761	**0.950**	0.843	0.440	-0.759	0.524
RTC4	-0.775	-0.809	0.871	0.677	-0.588	0.798	-0.746	-0.746	**0.960**	0.832	0.440	-0.778	0.502
RTC5	-0.773	-0.815	0.854	0.653	-0.587	0.801	-0.742	-0.763	**0.951**	0.828	0.474	-0.776	0.544
SA1	-0.764	-0.782	0.826	0.606	-0.573	0.767	-0.711	-0.762	0.824	**0.940**	0.382	-0.725	0.483
SA2	-0.747	-0.784	0.805	0.602	-0.589	0.759	-0.720	-0.741	0.822	**0.956**	0.396	-0.739	0.514

SA3	-0.747	-0.788	0.819	0.599	-0.546	0.736	-0.725	-0.720	0.820	**0.951**	0.392	-0.760	0.476
SA4	-0.754	-0.778	0.825	0.636	-0.567	0.781	-0.748	-0.730	0.832	**0.947**	0.441	-0.778	0.510
SA5	-0.743	-0.773	0.840	0.635	-0.621	0.806	-0.767	-0.777	0.835	**0.952**	0.449	-0.763	0.532
SC1	-0.550	-0.540	0.492	0.460	-0.525	0.537	-0.538	-0.552	0.413	0.373	**0.949**	-0.508	0.705
SC2	-0.512	-0.518	0.491	0.489	-0.483	0.533	-0.548	-0.542	0.407	0.372	**0.947**	-0.493	0.712
SC3	-0.592	-0.587	0.584	0.550	-0.529	0.621	-0.584	-0.625	0.497	0.477	**0.940**	-0.572	0.795
SE1	0.785	0.831	-0.826	-0.619	0.688	-0.794	0.822	0.796	-0.770	-0.741	-0.545	**0.944**	-0.597
SE2	0.784	0.838	-0.837	-0.653	0.694	-0.780	0.828	0.791	-0.791	-0.779	-0.531	**0.958**	-0.591
SE3	0.761	0.819	-0.824	-0.663	0.741	-0.808	0.823	0.808	-0.751	-0.745	-0.516	**0.953**	-0.561
TC1	-0.586	-0.582	0.573	0.545	-0.515	0.606	-0.610	-0.609	0.494	0.483	0.755	-0.575	**0.961**
TC2	-0.609	-0.585	0.614	0.530	-0.456	0.614	-0.572	-0.598	0.558	0.550	0.732	-0.594	**0.959**
TC3	-0.583	-0.586	0.568	0.562	-0.511	0.600	-0.607	-0.592	0.500	0.493	0.770	-0.596	**0.961**

Appendix C: List of Hypothesis

Construct	Hypothesis	Wordings	Inspired by Ref
Perceived ease of use (PEOU)	H1a	Perceived ease of use is positively associated with user's Attitude towards DMATTs	(Davis et al. 1989c; Tsai et al. 2019b)
	H1b	Perceived Ease of Use is positively associated with user's Perceived usefulness of DMATTs	(Davis et al. 1989c; Tsai et al. 2019a)
Perceived Usefulness (PU)	H2a	Perceived usefulness is positively associated with user's Behavioral intention to use DMATTs	(Davis et al. 1989c; Tsai et al. 2019c)
	H2b	Perceived Usefulness is positively associated with user's attitude towards using DMATTs	(Davis et al. 1989c; Tsai et al. 2019a)
Organizational Support (OS)	H3a	Organizational support is negatively associated with User's resistance to DMATTs	(Kim and Kankanhalli 2009)
	H3b	Organizational Support is positively associated with Users attitudes towards using DMATTs	(Kim and Kankanhalli 2009)
Self-Efficacy (SE)	H4a	Self-efficacy in DMATTs is positively ss c a d i h e ed e f e a o i te w t perc iv eas o us	(Chatzoglou et al. 2009; Hsu, Wang, and Chiu 2009; Venkatesh et al. 2003)
	H4b	Self-efficacy in DMATTS is negatively associated with DMATTs resistance	
Resistance to Change	H5	Resistance to change is negatively associated with user's Behavioral intention to use DMATTs	(Bhattacherjee and Hikmet 2007; Cabrera-Sánchez and Villarejo-Ramos 2020; Hsieh 2015a)
Inertia	H6a	Inertia is negatively associated with Perceived usefulness	(Polites and Karahanna

	H6b	Inertia is negatively associated with Perceived ease of use	2012; Tsai et al. 2019b)
	H6c	Inertia is negatively associate with user's Behavioral intention to use DMATTS	
	H6d	Inertia is positively associated with Resistance to change	
DMATTs anxiety	H7a	DMATTs anxiety is negatively associated with Perceived ease of use	(Robert K. Heinssen et al. 1987; Powell 2013b; Singh et al. 2013; Tsai et al. 2019c)
	H7b	DMATTs anxiety is negatively associated with perceived usefulness	
	H7c	DMATTs is positively associated with Resistance to change	
	H7d	DMATTs anxiety is negatively associated with user's attitude towards DMATTs	
	H7e	DMATTs anxiety is negatively associated with users' behavioral intention to use DMATTs	
Programming Anxiety	H8a	Programming anxiety is positively associated with DMATTs anxiety	Connolly et al 2009
	H8b	Programming anxiety is positively associated with statistics anxiety	
Statistics anxiety	H9	Statistical anxiety increases DMATTs anxiety	
Sunk Cost	H10a	Sunk cost is negatively associated with user's attitude towards DMATTs	(Hsieh 2015a; Kim and Kankanhalli 2009; Schmidt et al. 2020; Tsai et al. 2019c)
	H10b	Sunk cost is positively associated with Users Resistance to use DMATTS	
Transition Cost	H11a	Transition cost is negatively associated with users' attitude towards DMATTs	
	H11b	Transition Cost is positively associated with resistance to change	
Attitude	H12	Users attitude towards DMATTs is positively associated to user's behavioral intention to use DMATTs	(Tsai et al. 2019a)

Appendix D: Research questionnaire

Construct	Item	Ref
Perceived Usefulness (PU)	Using the DMATT will improve my performance in my job	(Davis 1989; Davis et al. 1989a)
	Using the DMATTs in my job will increases my productivity	
	Using the DMATTs will enhances my effectiveness in my job	
	Overall, I find DMATTs to be useful in my job	
Perceived Ease of Use (PEOU)	My interaction with DMATTs is Clear and understandable	
	It is easy to learn how to apply DMATTs	
	I find DMATTs to be easy to use	
	It is easy for me to become skillful at applying DMATTs	
Organizational Support (OS)	The organization provides me guidance on how to change to the new way of working with DMATTs	(Igbaria et al. 1997, 1995; Kim and Kankanhalli 2009)
	The organization provides me guidance on how to change to the new way of working with DMATTs	
	I am given necessary support and assistance to change to the new way of working with DMATTs by the organization	
	Training courses are readily available for us to learn and improve our skills in DMATTs	
	We are constantly updated on the latest DMATTs software (Tools) and techniques (algorithms)	
Attitude Towards DMATTs (ATT)	I believe my interest towards DMATTs will increase in the near future. The DMATTS will be better than the tradition auditing tools	(Davis 1989)
	It is a good Idea to use DMATTs in audits	
	I believe the use of DMATTs enhances audit quality	
	In general, I have a positive attitude about DMATTS	
Self-efficacy (SE)	Based on my own knowledge, skills and abilities, changing to the new way of working with DMATTs would be easy for me	(Kim and Kankanhalli 2009)
	I am able to change to the new way of working with DMATTs reasonably well on my own	
	I am able to change to the new way of working with DMATTs reasonably well on my own	
Behavioral Intention	I am willing to use DMATTs	(Davis 1989)
	Assuming I have access to DMATTS, I will try to replace my current	

(BI)	auditing tools and techniques with DMATTs	
	I plan to use DMATTs in the next \<n\> months	
	Assuming I have access to DMATTs, I intend to use it	
	Given that I have access to DMATTs, I predict that I would use it.	
Inertia (INT)	I will continue to apply traditional auditing CAATTs Tools because they are part of my everyday work life	(Polites and Karahanna 2012; Tsai et al. 2019b)
	Even though my current auditing tools and techniques do not have good effectiveness like what DMATTs offers, I will continue to apply them	
	I am already used to these traditional auditing tools and techniques (current way of working)	
Sunk Cost (SC)	I have already put a lot of time and effort into mastering the current way of working	(Kim 2011; Kim and Kankanhalli 2009)
	A lot of time and effort has gone into learning and becoming proficient with the current way of working	
	The time and resources I spent on traditional tools and techniques cannot be applied to DMATTs	
Transition Cost (TC)	Switching to the new way of working with DMATTs could result in unexpected hassles	
	I would lose a lot in my work if I were to switch to the new way of working with DMATTs	
	It will take a lot of time and effort to switch to the new way of working with DMATTs	
Programming Anxiety (PA)	I do not think I would be able to learn a data mining programming language	(Robert K Heinssen, Glass, and Knight 1987; Igbaria and Chakrabarti 1990)
	Anyone can learn programming if they are patient and motivated (reverse coding)	
	I feel programming skill is necessary in my work (reverse coding)	
	I think I would not be able to understand programming	
	I feel tense when I hear people talking of the need for auditors to learn and know how to program (programming Language-R,Python etc)	
	I don't intend to use DMATTs if I must implement it using a programming language that requires coding skills(Python,R,C,phP,Julia ,Javaetc)	
	I will adopt and use DMATTs if I am to implement it using a Visual Programing software (e.g. SPSS,RapidMiner,Weke etc)	

Statistics Anxiety (SA)	Statistics is worthless to me since it's empirical and my area of specialization is philosophical	(Hsu et al. 2009)
	I feel statistics is a waste to anyone in performing the work I do.	
	I do not want to learn to like statistics	
	I don't see why I have to clutter up my head with statistics it has little or no significance to my work life	
	I don't understand why somebody in my field needs statistics	
DMATTs Anxiety (DA)	DMATTs terminologies sounds like confusing jargon to me	(Robert K. Heinssen et al. 1987; Igbaria and Chakrabarti 1990)
	I hesitate to use or apply DMATTs for the fear of making mistakes that I cannot correct	
	I have/will avoid DMATTs because they are unfamiliar to me	
	The challenge in learning about data mining excites me(reverse coding)	
	You have to be a genius to understand algorithms in data mining(reverse coding)	
	If giving the opportunity, I would like to learn about and use DMATTs(reverse coding)	
	I feel that I will be able to keep up with the advances happening in the DMATTs field(reverse coding)	
	I am sure that with training and practice, I will be able to as comfortable working with DMATTs as I am working with my current tools (e.g., Excel, Microsoft word) (reverse coding)	
	I am sure of my ability to understand DMATTs results/reports	
	I am afraid that if I begin to use DMATTs I will become dependent upon them and lose some of my already acquired cognitive and technical skills	
	DMATTs makes me feel Uncomfortable	
	DMATTs make me feel Unease	
	I feel nervous about Using DMATTs	
Resistance to Change (RTC)	I do not want to change the auditing process because of the use of the DMATTS	(Bhattacherjee and Hikmet 2007; Hsieh and Lin 2018)
	I do not want to change how I make auditing decisions because of the	

	use of the DMATTs	
	I do not want to change my interactions with other professional staff because of the use of the DMATTS	
	Overall, I do not want to change the current working methods because of the use of the DMATTs	

CHAPTER 4:

The Role of Institutional Entrepreneurs in New Practice Creation: The Case of SDGs Audits[46]

Abstract

This study was aimed at investigating and understanding the creation of the novel public sector auditing practice "SDG audits". To realize this aim, we employed institutional entrepreneurship and institutional work as our theoretical lens. Using a qualitative approach supported by archival data, we found that the adoption of the SDGs created some challenges and precipitating jolts to the traditional performance auditing practice. This disruption led to a collective action to create a proto institution called SDG audits, which was simply a hybrid combining existing performance audits principles with those of the agenda 2030. Based on our findings we conclude that, the overall creation work of SDG audits was a performance audits maintenance work, meaning SDG audits did not replace performance audits but simply augments it to meet the challenges posed by auditing SDGs.

Keywords: audits, Supreme Audit Institutions, Agenda 2030, institutional work, institutional entrepreneurship

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1. Introduction

The adoption of the UN's Agenda 2030 (SDGs) termed "2030 Agenda for sustainable developments", comprising 17 sustainable development goals, 169 targets, and 232 indicators, is seen to be one of the most fundamental and or radical changes in public sector auditing, leading to the emergence of a new audit ecosystem as well as new expectations from Supreme Audit Institutions (here after SAI) audit work (INCOSAI 2019). As a result, evokes the need for SAIs to rethink their methods and operations so as to add value through quality and timely audits (information) on policy issues while maintaining their relevance as the voice of accountability and transparency that stakeholders can rely on (INTOSAI, 2019).

Acknowledgments from international organizations especially the umbrella organization for Agenda 2030 the UN, through its UN GA resolutions A/66/209, A/69/228, A/69/237, [47] implicitly calls for SAIs to adopt and embrace agility, that is adapting quickly to the new normal of auditing guided by concepts of SDG such as the whole of Government approach (W.O.G), Leave No-one Behind (LNOB), etc. (INTOSAI/IDI 2017). Each government by default is responsible for putting in place mechanisms, directives, and policies to enable the realization of sustainable development. SAI, being one of the main promoters of public accountability, are tacitly charged with enforcing accountability at national and or local levels to enable the smooth attainment of SDGs-related policies and programs set by their governments.

Such disruptions in the SAIs environment have always impacted the profession, leading to modifications in approach and methodology.This was the case in the advent of NPM (Lapuente, Walle, 2020; Leeuw, 1996). Where SAI's work expanded beyond its traditional boundaries to provide a broader cross-cutting view of how processes and programs function across government (OECD 2016). In such a new ecosystem, accountability shifted from accountability for the process to accountability for performance (OECD 2016). SDGs adoption echoes and reinforces the need and demand for high-quality audits and scrutiny of public administration SDG implementation policies and activities (INTOSAI 2016,2018). Strategic documents like the INTOSAI 2017-2022 strategic plan emphasized, the role SAIs can play using their mandate in following up and reviewing SDGs at National and Local Levels (INTOSAI 2018).

These pressures around the SAI's environment have let them create a new approach called SDG audits to tackle the demands of auditing Agenda 2030, SDG goals. Thus, the focus of this study, investigating the creation and institutionalization of the new practice of SDG audits. The approach of looking at emergence and embedding (Anand et al, 2007) is very important in understanding the genealogy of emerging practices, especially in the case of SDG audits, whose effectiveness is still yet to be felt and or debatable by grassroots stakeholders. This research seeks to firstly study the process of emergence of SDG audits and secondly, the process of institutionalization (and or embedding) of the new practice (SDG audits) by looking at actors and their strategies to institutionalize SDG audits. To attain the objective of understanding the

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[47] UN resolution A/RES/69/228: "*Promoting and fostering the efficiency, accountability, effectiveness, and transparency of public administration by strengthening supreme audit institutions.*"

emergence, creation, institutionalization, and diffusion of SDG audits we pose the following research questions:

R1 What is SDG audits?

R2 Who are the creators of SDG audits?

R3 What are the roles or strategies used by actors in creating SDG audits?

To answer the above questions, institutional theories were borrowed to act as a lens to our analysis, specifically the study was grounded on institutional work and entrepreneurship, that is institutional works looking at "purposive actions"(Thomas, Lawrence and Suddaby 2006a) of institutional entrepreneurs(Battilana, Leca, and Boxenbaum 2009a; Hardy and Maguire 2012) to create SDG audits, while institutional entrepreneur here examines actor's both passive and active in the creation process. The analysis also was guided by the 3 dimensions of institutional entrepreneurship (Lawrence and Phillips 2019), that is relational, materials and discursive dimensions respectively.

Most research on accounting practice development has focused on private sector professional service firms (Heusinkveld & Benders, 2002; Suddaby & Greenwood, 2001, Anand et al., 2007; Gardner et al., 2008; Heusinkveld & Benders, 2005; Morris, 2001).

Research on sustainability audit and assurance ,especially has focused on the private sector specifically on the supply side of the practice, that is looking at how or who delivers these practices (Michelon et al. 2019) .Another strand have explored the role of actors or the process of institutionalizing these practices (Hazaea et al. 2022; O'Dwyer, Owen, and Unerman 2011a). Although sustainability audits and assurance to an extent have been studied in the private sector (still at an infancy phase), however public sector auditing research with respect to sustainability is still at an embryonic phase (Manetti and Toccafondi,2012). Accounting research has paid more interest on investigating how new practices are legitimated and diffused with less focus on how new practices are created in the first place.Institutional theorist have at times investigates the bigger picture considering the act of legitimization and diffusion as part of a practice creation process. Thanks to the insights from neo institutional theorist, institutional entrepreneurship and institutional works scholars have been able to address practice creation.

The rest of the paper is structured in the following fashion: in section 2 and 3, we focused on reviewing public sector audits, institutional work and institutional entrepreneurship literatures respectively, moving unto section 4, we presented our research methodology, then section five to 6 was focused on answering our research questions through case analysis, section 7 was dedicated to discussion of our results and we concluded our work with section 8.

2. SAIs and Public assurance

As earlier pointed (in the introduction), in studying institutional change, it is very important to tackle it from two fronts, process emergence and or process embedding or institutionalization. Based on this approach, we would look at two predominant streams of literature and theories, that's research on the creation of the new practice area and research focusing on practice institutionalization.

The importance of new practice development in maintaining and or catching up with

stakeholders emerging demands cannot be over emphasized (Benders, Van den Berg & Van Bijsterveld 1998; Kipping 1999; Anand et al, 2007), thus, new practice area creation involves the development of new portfolios call areas of expertise that strengthens performance in this new area (Morris, 2001; Morris & Empson, 1998; Werr & Stjernberg, 2003; Werr et al., 1997; Anand et al., 2007; Gardner et al., 2008).

Researchers have also focused on how new practices become institutionalized. Theories and studies in this stream of research are mainly focused on understanding how organizations embed and established practices, but also how these practices are effective. The question of effectiveness has implicitly raised many questions such as: are institutions just being rhetorical without backed reality? how organizations strive to maintain legitimacy of their actions or existence? These questions are of importance since researchers have found evidence of management adopting and or institutionalizing certain practice just as a lip service to gain legitimacy in the eyes of stakeholders, for example, studies in management accounting(see Clementino and Perkins 2021).

Previous studies have investigated the process by which accounting and auditing claim expertise in other jurisdictions ,they   argued that audit erodes its jurisdiction by attaching expertise claims to solve perceived problems in a given area(Fogarty, Radcliffe, and Campbell 2006; Gendron, Cooper, and Townley 2007a; Power 1992, 1996, 1997)

Due to the lack of empirical(scholarly) literature on SDG audits, the nearest cousin to SDG audits Sustainability assurance, could help elucidate our understandings of what are the normative underpinnings of SDG audits.

A more generic definition of the act of auditing sustainable development reports derived from sustainable assurance literature, is said to be, the act of verification on an entities or organization's behavior in financial(economic), environmental and social dimensions (Wallage 2000; Beckettand Jonker, 2002; Issakson and Garvere 2003; Fraser,2005).

Sustainability audits seek to verify if an entity's operation corresponds with its policies, standards, and goals in different spheres (social, environmental, and economic dimensions) have been attained (Larsson 1995, p.53, Power 1997a).

Sustainability assurance is widely practiced both in the private and public sector even before the advent of agenda 2030. Although there is this great debate where scholars are arguing that there exist no substantial differences between private and public sector sustainability assurance (Holdsworth 2007), others contradict that with some evidence, showing the existence of differences. For example, Sustainability Assurance being an expansion of traditional auditing methods (Power 1997), containing Financial and other audits (O'Dwyer), Although, Public Sector auditors perform financial audits by nature they have wider objective than that of the private sector auditors and also focuses on more extensive accountabilities. Public sector lays more emphasis on information relating to policy and policy effects, which are usually presented in the form of key figures and performance indicators NIVRA [48] (2008). Private sector sustainability assurance practices are usually seen to be symbolic instruments used in

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[48] Royal Dutch Institute of Chartered Accountants (Royal NIVRA)

convincing stakeholders that an entity is committed to sustainability reporting(attesting the quality of sustainability disclosures).It is even argued that assurance of sustainability reports has no relationship with the quality of disclosures (Michelon, Pilonato, and Ricceri, 2014), a rather inconclusive result shows that the actual contribution of assurance is difficult to be determined (Ball, Owen, and Gray,2000; Park and Brorson, 2005).

On the public audit supply side[49], a large part of service institutions successes is due to rhetoric and political skills of practitioners in persuading and actively influencing the ecosystem or environment in which they operate in (Suddaby et al. 2022).Today there is a great interest in sustainability audits and assurances due to the increase in demand for social, environmental, and other non-financial information accountability by stakeholders (Boiral et al., 2019).This demands both in the public and private sector has led, to attempts in creating new assurance practices and or expanding and upgrading existing ones (Kolk and Perego 2010; O'Dwyer and Owen 2014; O'Dwyer, Owen, and Unerman 2011). In Power's (1996) paper titled "Making things auditable", power asserted that "audit is an activity involving two main types of processes: 1)the negotiation of a legitimate and institutionally acceptable knowledge base and 2) the creation of environment being receptive to the knowledge", in other words the profession erodes its institutional boundaries through   political and social processes to gain relevance of expertise and legitimacy in a new area(Channuntapipat, Samsonova-Taddei, and Turley 2019; Gendron and Barrett 2004; O'Dwyer, Owen, and Unerman 2011; Power 1992, 1996b, 2003) Over the years, sustainable development goals (SDGs) attracted the attention of researchers (Biermann et al., 2017; Hak et al., 2015; Holden et al., 2017).

This interest is also due to the assertion that accounting plays an important role in providing insights and foresight to policy formulation, implementation, and evaluation (OECD 2016) advancing sustainable development.The 2016 OECD report presents evidence that shows SAIs Portfolio transitioning beyond its traditional role of verifying government expenditure and performing oversight. Although, SAIs through their traditional role of providing external oversight of government accounts, play a pivotal role in ensuring and promoting accountability of a state, limiting them to that only, would be myopic. They have an "untapped potential", resulting from their evolved role which goes beyond traditional oversight to venture into 'policymaking and policy decisions' (OECD 2016), By doing so "SAIs can provide insights to improve the functioning of processes and programs and foresight to aid governments in adapting to future trends and risk"(OECD 2016), thus, contributing to systemic issues through an evidence-based approach, enabling better policy formulation implementation and evaluation (OECD 2016).

SAI's role has also expanded beyond its traditional functions to the provision of a broader cross-cutting view of how processes and programs function across government (OECD 2016). The evolution of SAI has been enabled by the ever-evolving economic, political, and institutional developments in the public sector (Noussi, 2012).

Before the advent of SDGs, links between developmental issues and goals have been recognized by experts, policymakers, and other stakeholders and in some cases, policies were

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[49] Her we mean the auditors or audit service providers, such as the BIG 4, SAIs

made considering links between goals. For instance, links between policy on health and population growth or increase in life expectancy or pollution and health (Le Blanc 2017). However, the main point of difference between SDGs and previous developmental goals like the MDG is that SDGs explicitly acknowledges and recognizes these links(interlinks) between them (Le Blanc 2017).

SAIs through their independent external oversight function plays a key role in the government accountability system (Suzuki 2004), they do so by keeping government checked thereby promoting transparency, accountability, efficiency, and effectiveness. These are all ingredients or catalyst for improving the performance of government institutions and agencies (Stapenhurst & Titsworth 2006, Santis 2007;2009; Melo et al 2009; Montero and Le Blanc,2019, Suzuki 2004), which to a greater extend such a role is so pivotal in the achievement of National and Local development objectives and the globally agreed 2030 agenda (SDGs) (Guillán Montero and Le Blanc 2019). Majority of SAIs, have experience in tracking or contributing to every single stage of the policy cycle (Policy formulation, Policy implementation, policy monitoring, and evaluation) (OECD 2016): "*SAIs are tracking, formally or informally, cross-cutting issues that help to explain deficiencies and shortcomings in value for money programs and policies*" *(OECD 2016).*

Presently a vast majority of SAIs are extending from their traditional audit role to investigate non-traditional audit areas relating to the core elements of policy formulation such as audit activities examining policy formulation (OECD 2016). Auditing as a profession always erodes its traditional jurisdiction to meet the demands of the time (Power 1994; Power 1997; Shore and Wright 1999),Power (1994) calls it "the audit explosion"[50].Our work focusing on SDG audits in the public sector, strives to understand the creation and institutionalization of SDG audits. In doing so we were mainly guided by two neo institutional theories that is institutional entrepreneurship (see Battilana, Leca, and Boxenbaum 2009) and institutional work see (see Thomas B. Lawrence and Phillips 2019; Thomas B. Lawrence and Suddaby 2006a) .

3. Institutional change, institutional entrepreneurship, and institutional work

Research on institutions has long been focused on studying how institutions act to stabilize and or influence social processes (DiMaggio & Powell., 1983). The research focus has also shifted to studying how institutions change (institutional alteration) (Colomy,1998, Di Maggio,1988). Institutional change may be triggered by exogenous forces-external shocks or 'jolts'(Hoffman 1999; Meyer et al. 1983) which alter existing institutional order, norms, or structures, and endogenous factors or internal factors (Wijen and Ansari 2006).

Previous research looking at change in an institutional environment has partly been informed by the conceptualization that says, institutions 'are durable sociocultural structures that provide stable sets of meaning, rules, and norms on which organizations depend for their understanding of appropriate behaviors'(Micelotta, Lounsbury, and Greenwood 2017a), thus

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[50] "In the 1980s and 1990s, 'audit' migrated from its original association with financial accounting and entered new domains of working life."

such change are termed as *exogenous change.* Example ,of which includes: 'shifts in potential regimes'(Clark and Soulsby 1995; Whitley and Czaban 1998), socio-political upheavals such as wars, revolutions (Allmendinger and Hackman 1996), technological changes and their impacts (Romanelli and Tushman 1994) regulatory change (Bacharach, Bamberger, and Sonnenstuhl 1996), competitive pressure and resources scarcity (Thornton, Ocasio, and Lounsbury 2015).

Theorization in exogenous institutional change has given birth to three strands of research. The first strand stems from the mix of institutional and population ecology, here the main argument is that institutions are 'unable to adapt sufficiently quickly to the mutations of their institutional environment(Ruef and Scott 1998) since 'environmental changes trigger selection processes' leading to the fading away of existing 'organizations forms and practices'(Ahmadjian and Robinson 2001),thus paving the way for 'new ones through Isomorphic diffusion'(Lee and Pennings 2002). Contrary to the previous strand, the second strand argues that organizations can adapt by responding to disruptive changes, here organizations are seen to be reflexive and agile, coming up with strategies and structures to adapt and maintain their position in a field(Lamberg and Pajunen 2010).

The third stream looks at 'shifts in field-level institutional logics'(Thornton et al. 2015), it is different in that ,here change is conceptualized as a complex, multi-faceted process, that is not limited to selection or adaptations processes'(Micelotta et al. 2017a). Here the shift in the dominant logic that is embedded in institutionalized institutions(taken-for-granted, values beliefs, cultural norms) can drastically change an institution(Greenwood et al. 2011; Ocasio, Thornton, and Lounsbury 2018; Silvola and Vinnari 2021). This strand of research has been so influential in enabling theory construction and research aimed at explaining other forms of institutional change (Wright and Zammuto 2013; York, Hargrave, and Pacheco 2016).Such as change triggered by institutional actors (IE)-*endogenous change*, in order words, change triggered by institutionally embedded actors. Research in this lane takes into cognizance the 'paradox or embedded agency'(Battilana et al. 2009b; Holm 1995a; Skelcher et al. 2008), which begs the question: 'how can embedded actors break away to form a new institutional template (Garud, Hardy, and Maguire 2007a; Seo and Creed 2002a). Thus, the attention here has leaned towards looking at 'which organizations are agents of change, why are they considered change agents, what disruptive strategy they applied'? This strand of research introduces the concept of institutional entrepreneurs as actors who initiate and implement change, and institutional works as change actions taken by actors.

In summary, two of the most prominent emerging concepts in these streams of research are a) *institutional entrepreneurship* (IE) phenomenon, research in IE aims at understanding 'the agency dimension underpinning institutional change (Eisenstadt 1980; Fligstein,1997; Gerud et al.,2002), b) *institutional work*, focuses on actors' action to alter or maintain a taken for granted institutional template.

3.1. Institutional entrepreneurship

Institutional entrepreneurship refers to the "activities of actors who have an interest in particular institutional arrangements and who leverage resources to create new institutions or

to transform existing ones" (Maguire et al. 2004, p. 657). A core characteristic of institutional entrepreneurs is represented by the act of mobilizing 'projective' agency (Dorado,2005). It entails 'the imaginative generation by actors of possible future trajectories of action, in which perceived structures of thought and action may be creatively reconfigured in relation to actor's hopes, fears, and desires for the future' (Emirbayer & Mische,1998: p. 971). Here the imagined paths or trajectories presents the 'content' of the change process and guides institutional entrepreneurs' actions to tackle 'a vital problem or societal need' and to give a proposition for a remedy stating the "functions and goals to be fulfilled by the proposed alteration "(Colomy, 1998: p.272).

The core aim of institutional entrepreneurship theory is about explaining "how actors can shape the institutions while being constrained by them"(Leca, Julie Battilana, and Boxenbaum 2008).

In breaking this paradox, Fischer (1996), argues that although auditors are "highly constrained by their institutional knowledge regarding the appropriate approach to conducting an audit ,crisis in the field may lead to some auditors, to unlearn or discredit existing status quo or practice thus are able to realize and internalize the value of alternative audit technologies.

Early institutionalist, with interest on the similarity and stability of organizational structures (Thomas B. Lawrence and Suddaby 2006b; Smets and Reihlen 2012), focused more on examining and explaining convergence change induced by Isomorphic pressures in organizational fields or processes of homogenization through isomorphism (DiMaggio and Powell 1983; Meyer and Rowan 1977; Scott 1987a; Tolbert and Zucker 1983; Zucker 1977, 1987).This approach with 'over emphasis on the social environment imposing upon ,-rather than also-emerging from-human interaction'(Smets, Morris, and Greenwood 2012) have faced criticism such as the lack of explanatory power in conceptualizing divergent change (Barley and Tolbert 1997; Cooper, Ezzamel, and Willmott 2012). Particularly the 'Paradox of embedded agency'(Holm 1995b; Seo and Creed 2002b), that is the question of how actors can 'change institutions if their actions ,intentions and rationality are all conditioned by the very institutions they wish to change'(Battilana and D'Aunno 2009a; Holm 1995b). In an attempt to solve this paradox, neo institutional theorist take a step further into looking at change arising from endogenous activities(forces), thus the birth of Institutional entrepreneurship as a theoretical lens to investigate institutional change.

Central to the idea of who is a change agent that is institutional entrepreneur(IE), is the assertion of actor-hood to be an individual, organization or group or social movement with a proposed initiative that brings about a change that diverges 'from the dominant institutionalized template '(Battilana 2007).For example, in our case of Performance audits(PA),Financial audits(FA),compliance audits (CA), are all institutionalized ,taken-for-granted templates within the SAI's professional life. Institutional entrepreneurs have largely been seen as change agents pursuing certain interest through strategical and calculative actions (Beckert 1999; Child, Lu, and Tsai 2007; Fligstein 2001; Garud, Hardy, and Maguire 2007b; Greenwood and Suddaby 2006; Lawrence and Phillips 2004; Levy and Scully 2007a; Wijen and Ansari 2007). DiMaggio (1988:14) states 'New institutions arise when organized actors(IEs) with sufficient resources see in them an opportunity to realize interests that they value highly' .IEs are resource mobilisers (Battilana 2006 Garud et al. 2007; Khan, Munir, and Willmott 2007; Levy and Scully 2007a;), mobilisers of other actors (socially skilled)(Fligstein 2001; Garud et al. 2007;

Lounsbury and Crumley 2007b; Perkmann and Spicer 2008; Suddaby and Greenwood 2005b;), meaning creators (Misangyi, Weaver, and Elms 2008; Perkmann and Spicer 2008a; Rao and Giorgi 2006; Suddaby and Greenwood 2005a; Zilber 2007b) to some extent are seen as leaders (Levy and Scully 2007b; Wijen and Ansari 2007), as visionaries (Beckert 1999; Perkmann and Spicer 2008a) reflexive or reactive agents (Beckert 1999; Greenwood and Suddaby 2006; Mutch 2007a). The different roles played by institutional entrepreneurs are aimed at attaining or creating new institutional structures (Battilana, Leca, and Boxenbaum 2009c; Beckert 1999; Dimaggio 1988; Greenwood and Suddaby 2006; Hardy and Maguire 2012; Kraatz and Zajac 1996; Leblebici et al. 1991).

Prior researchers have argued that ,most boundary spanning activities and or change activities are too complex for a single actor (entrepreneur) to unilaterally enforce change (Huxham and Vangen 2000; Trist 1983) rather change in such an environment requires 'a spectrum of actors'(Thomas B. Lawrence and Suddaby 2006b; Wijen and Ansari 2007), working simultaneously and 'share responsibilities'(Greenwood and Suddaby 2006). This argument supports the Collective Institutional Entrepreneurship (CIE) concept defined as *"the process of overcoming collective inaction and achieving sustained collaboration among numerous dispersed actors to create new institutions or transform existing ones"* (Wijen and Ansari, 2007, p. 1079). Van de Ven and Hargrave (2004) describe collective action as a "political action among distributed partisans, and embedded actors to solve a problem or issue by changing institutional arrangement". CIE also attempts to reconcile the agency- structure paradox (Wijen and Ansari 2007).

Prior studies on institutional entrepreneurship have found IE to be highly influential in institutional field-shaping activities such as the 'creation of new formal institutions, including, organizational forms, practices, and identities'(Hardy and Maguire 2012), they have also been instrumental in promoting the adoption of new practices (Boxenbaum and Battilana 2005; Garud, Jain, and Kumaraswamy 2002; Hardy and Maguire 2012; Leblebici et al. 1991; Oakes, Townley, and Cooper 1998).

Institutional change may lead to new power configurations, that is dominant actors may become less dominant, in other situations, the dominant actor may change the way things are done by remaining dominant or simply use change as a way to maintain dominance, and the outcome of this lead to two different narratives of IE "(1) Actor-centric narrative emphasizing the deliberate and strategic actions of a particular institutional entrepreneur (Hardy and Maguire 2012); (2) process-centric – the emphasis is placed on what comes with the institutional entrepreneurship process(Hardy and Maguire 2012). IEs are seen to be reflexive (Mutch 2007b; Seo and Creed 2002a) and opportunistic, they make change by responding to some 'stimuli' or force or pressures which may cause uncertainty or be problematic with existing institutional arrangements, so IE make use of their 'superior political and social skills' to intervene strategically 'to realize institutional change through the combination and mobilization of resources, rationales and relations in creative ways (Fligstein 1997). Although IE can be summarized into actor and process-centric narratives, the two narratives are not 'mutually exclusive 'for example the actor centric narrative narrates the process(activities) in which the actor engages, and the process-centric narrative usually single out a certain actor(s) as a point of reference (Hardy and Maguire 2012). In a process-centric approach to

institutional entrepreneurship 'activities of diverse, spatially dispersed actors'(Lounsbury and Crumley 2007a) converge through a collective action to create institutional change. Thus, an institutional entrepreneur is seen to be an actor who promotes institutional change through institutional entrepreneurship- the process through which change is attained or implemented. Inspired by the work of (Di Maggio 1988) and other studies . Battilana et al. (2009) argues that institutional entrepreneurs are change agents but not all change agents are institutional entrepreneurs.They went further to state that for an agent(s) to be considered as an institutional entrepreneur they must satisfy the following two conditions: 1) 'Initiate divergent change(s)'; and 2) 'actively participate in the change process.

Divergent change here signifies change that 'breaks with institutionalized (taken-for-granted) templates for organizing within a given institutional context'(D'Aunno, Succi, and Alexander 2000; Battilana 2006; Greenwood and Hinings 1996), the taken-for-granted template is often referred to as institutional logics(Dobbin 1994; Scott 1987b; Suddaby and Greenwood 2005a).Scott (2014) calls it the "institutional pillars". Divergent change breaks embedded templates while non-divergent change is change aligned with the institutions in a field, also divergent change can be 'initiated at the periphery of an organization or at the core'. An actor to be considered as an IE, must not only initiate divergent change but must actively participate by mobilizing resources to effectuate or realize change (see Battilana et al. 2009c)

The institutional entrepreneurship literature not only provides criteria to classify an actor as an institutional entrepreneur but also provides lines of inquiry, looking at and explaining factors or conditions that enable the 'emergence of institutional entrepreneurship' and the strategies and resources an actor uses in promoting and implementing institutional change (Battilana et al. 2009b). Prior research has identified three key enabling conditions (Battilana et al. 2009b; Hardy and Maguire 2012):

1) field characteristics
2) actors' social position
3) actors' specific characteristics

Prior research argues that the field conditions 'create opportunities for institutional entrepreneurship'. An institutional field characteristic can greatly influence or enable or even hamper an actor's institutional entrepreneurial activities of divergent change initiation and implementation, while, actors' social position affects the way individual actors perceive field conditions', to each its own 'viewpoint' of field conditions, hence exposing them to different types or levels of resources (Bourdieu 1988). Hardy and Maguire (2007) termed these conditions as 'stimuli'; these 'stimuli' may results from uncertainty, 'the degree to which future state cannot be accurately anticipated and predicted accurately'(Pfeffer and Salancik 1978). The failure to define rational strategies by actors (in uncertainty) gives room for opportunistic behavior as different actors strive to solve the problem of uncertainty hence leading to institutional entrepreneurship that addresses the uncertainty. A group of studies have focused on looking at the 'tensions'(Dorado 2005; Greenwood and Suddaby 2006; Rao, Monin, Durand, et al. 2003; Seo and Creed 2002a; Zilber 2007c) and 'contradictions' (Rao, Monin, and Durand 2003; Seo and Creed 2002a), these conditions are recipes for change, more common examples of 'jolts and crisis' may include: social upheaval, technological disruption, regulative change (Battilana et al. 2009c).

Finally, the degree of heterogeneity and institutionalization are also important enabling conditions that have drawn the attention of scholars. When the degree of heterogeneity is high that is the 'presence of multiple institutional orders or alternatives provides an opportunity for institutional entrepreneurship'(Clemens and Cook 1999; Sewell 2004). The degree of institutionalization may also influence an actor's agency toward institutional change. Hardy and Maguire(2007) call it the 'state' of the field- be it emerging, mature, stable, or in crisis (Fligstein 1997) each state of the field has been associated with the likelihood of IE emergence. For example in emerging institutions, the likelihood of IE emergence is higher due to 'the lack of strongly institutionalized practices resulting in fluid relationships conflicting values and the absence of clarity in definable norms' this, in turn, poses issues, creating opportunities for actors to emerge with solutions(Maguire, Hardy, and Lawrence 2004).

Actors' social position determines their relations and connections in the environment in which they are embedded in (Emirbayer and Mische 1998a). Social position may influence an actor's 'perception of the field'(Bourdieu, 1977) ,and their access to resources required for institutional entrepreneurship (Lawrence 1999). Social relationships and resources provides the actor with 'institutionally defined interest and opportunities'(Bourdieu, Wacquant, and Lacombe 1993), and in some cases the possibility to exert power over the field at a particular point in time (Bourdieu, 1986). In a nutshell, actors do not have power but 'they occupy subject position' that confers on them power' exercisable in or on a particular field (Hardy and Maguire 2012).

The second criteria of how divergent change are induced and or implemented by an actor has gained momentum in the institutional theory literature (Garud et al. 2007b; Thomas B. Lawrence and Suddaby 2006b).Especially an increase in focus on 'the purposeful institutional work '.Here institutional works provides a vocabulary to categorize tactics and strategies used by institutional change agents (IE) in implementing the change process (Micelotta, Lounsbury, and Greenwood 2017b). Referencing the change management literature, generally, it has emphasized how 'change agents undertake specific activities (strategic and purposeful) to support and promote' change projects(Beer et al. 1990; Judson 1991; Kotter 1995). In explaining or exploring the second criteria of an institutional entrepreneur- that is, we recall that, an Institutional entrepreneur is one who does not only initiate change but must mobilize resources and work towards its implementation, we adopt the institutional work (IW) as a vocabulary categorization of different strategies and tactics taken by institutional entrepreneurs to implement divergent change (which may be change to create, maintain or destroy an institutional field) (Micelotta et al. 2017a).

3.2. Institutional Work

The core or common characteristics of different agential processes of institutional change is that of actors requiring purposeful efforts (Perkman & Spicer,2007). According to Lawrence and Suddaby (2006) this purposive effort is called 'institutional work'. Institutional work is a holistic concept that has been well documented in previous literature on institutional entrepreneurship, institutional change, and deinstitutionalization (Lawrence et al 2009). It was first theorized by Lawrence and Suddaby (2006, P.15), as the purposive action taken by actors to create, maintain or disrupt an institutions. (Hardy and Maguire 2018; Thomas B. Lawrence

and Phillips 2019; Thomas B. Lawrence and Suddaby 2006a). How these institutional entrepreneurship or actors change institutions is a question that let to (Lawrence and Suddaby 2006) to develop the institutional work as a theoretical lens used in explaining the actions of actors toward institutional change.

On practice creation, the literature categorized actors institutional work into three. Based on Thomas B. Lawrence and Suddaby (2006). The first category is described as "Overtly political work in which actors reconstruct rules, property rights and boundaries that define access to material resources", they referred to this as Vesting, defining and advocacy works. The second category of activities "emphasized actions in which actors' belief systems are reconfigured", works in this category focus on changing norms, constructing new identities and new networks, lastly, institutional work or actions of mimicry, theorizing and educating "involves actions designed to alter abstract categorizations in which the boundaries of meaning systems are altered" (See Lawrence and Suddaby, 2006). Different 'institutional work' can address Scott's (1995) 'Pillars' of an institution that is the normative, regulative, cognitive pillars respectively. Table 1, depicts a taxonomy of institutional work, with respect to the works of (Lawrence and Suddaby 2006), the different pillars of an institutions (Scott 2014)affected by these works, and the categorization of Institutional work by (Perkmann and Spicer 2008a).

Table 1: Taxonomy of Institutional creation work

Institutional Works typology (Lawrence and Suddaby 2006b)	Pillars of an institution (Scott 2014)		Classification according to (Perkmann and Spicer 2008a)
Advocacy	Regulative	Pillar	Political work
Defining	Regulative	Pillar	Political work
Vesting	Regulative	Pillar	Political work
Constructing identities	Normative	Pillar	Cultural work
Changing normative association	Normative	Pillar	Cultural work
Constructing normative networks	Normative	pillar	Cultural work
Mimicry	Cultural-cognitive Pillar		Technical work
Theorizing	Cultural-cognitive Pillar		Technical work
Educating	Cultural-cognitive pillar		Technical work

Actors' ability to undertake institutional work is strengthened by some 'must-have' social skills, for example 'the ability to induce co-operation in others' (Fligstein 1997). The ability to exert authority, set agendas, frame arguments, creatively bring together unusual components, and engage in bargaining and brokering(fligstein,1997). It is normal occurrence that different agents are endowed or embodied with different 'social skills', especially when the operational purposes of existence of the different groups who seek institutional change are different (division of Labor in institutional change) (Campbell,2004). Thus, some actors will be more advantaged and powerful or influential in certain institutional works than others.

Lawrence and Suddaby (2006) came up with a framework (see table 1) looking at the different institutional entrepreneurship activities (institutional works), taken by institutional actors (institutional entrepreneurs) to realize institutional change. Lawrence and Suddaby (2006 pp.234-235) argue that each organizational field actors whose interest are not served by existing institutional arrangements and will consequently work, when possible, to disrupt the extant set of institutions'. Regardless of the type of innovation, an action would be needed to either stabilized (maintaining) or change the institution (creating, disruption) (Lawrence, Suddaby, & Leca, 2011). Institutional work acknowledges the role "institutional entrepreneurs" may play as change agents (e.g., DiMaggio, 1988; Kaplan, 2015; Kilfoyle & Richardson, 2015; Oakes, Townley, & Cooper, 1998; Teece, 2012; Lawrence and Suddaby's (2006: 215

Organizational theorists acknowledged the fragmented nature of institutional fields and posit that it consist of 'dispersed and heterogeneous actors with more or less competing interest'(Greenwood et al. 2011; Kraatz and Block 2012). Lawrence and Philips (2019), argues that the traditional account of institutions and agency does not give a full picture of actors involvement, prior research has mainly focused on locating actors for example at the core or periphery of the field (Greenwood and Suddaby 2006; Leblebici et al. 1991), their motivation , resources or abilities , this provides a partial view of who actors are in relation to the institutions that guides their existence.

This partial view reinforces their argument that institutional work research takes on an extensive approach, with emphasis on the "idea that different people in communities and societies interact with institutions in different ways with different resources and responsibilities and different appreciations of the degree to which they can and should influence those institutions" (Lawrence and Phillips 2019). This argument motivate their typology or categorization of roles individuals or actors can play in institutional arrangement, they can play the role of 'institutional entrepreneur'("actors who leverage resources to create new institutions or transform existing ones") (see Dorado 2005; Garud et al. 2002; Maguire et al. 2004) , 'institutional caretaker'("actors who work to maintain institutions") (see Currie et al. 2012a; Dover and Lawrence 2010; Maguire and Hardy 2009)), and 'institutional troublemaker'(actors who work to disrupt existing institutions) (see Hardy and Maguire 2010; Maguire and Hardy 2009).

These different roles to an extent match the three core institutional works intentions of creating, maintaining and disrupting an institution. Though these roles are respectively matched to the 3 broad categories of institutional works (creating, maintaining, and disrupting,), research has proven that actors while dominantly playing a particular role (for example the creating role), may borrow strategies from the others (caretaking/maintaining, troublemaking/disrupting), thus they are not mutually exclusive to a certain extent. An actor(s) might be creating a new institution by transforming or disrupting an existing institution.

Central to most findings of research which applied institutions work as a theoretical lens is authors being able to explain or find a relationship between group action and institutional change that 'combines conflicting and competing interest in newly negotiated institutional orders '(Hardy and Maguire 2012; Helfen and Sydow 2013; Smets et al. 2012; Zietsma and Lawrence 2010). Institutional entrepreneurship related studies have extensively studied new practice creation (Garud et al. 2002; Greenwood and Suddaby 2006; Lawrence and Phillips

2004; Maguire et al. 2004). New practice creation has created a 'bridge' between institutional and practice related research traditions (Gomez and Bouty 2011; Lounsbury and Crumley 2007b; Rao 2004; Zietsma and Lawrence 2010). Institutional entrepreneurship has been at the core of institutional work literature, providing the motivation and push for the emergence of scholarship investigating how and why 'actors' work' towards the creation , maintenance or destruction of an institution (Thomas B. Lawrence and Suddaby 2006b). Lawrence and Suddaby (2006), essay on institutional work serves as a converging point to diverse literature on institutional entrepreneurship, deinstitutionalization, and institutional maintenance. Institutional work shifted the attention on accomplishment to focus on activities, this gives it a broader view to not only include, success but also failures, acts of resistance and transformation, not leaving out intended and unintended consequences (Lawrence, Suddaby and Leca, 2009). Since our case is dealing with the creation of a new institution 'SDG audits', we would stick with the practice creation work proposed by (Lawrence and Suddaby 2006b). Our research presents the following framework (Figure 1), to understand IEs role in SDG audits creation and institutionalization.

Figure 1 summarizes our theoretical literature and serves as lens for exploring SDG audit creation. It depicts the relationship that exist between actors and the institutional field. Field level enabling conditions may emerge as a result of crisis or jolts (Holm 1995b), the degree of field heterogeneity(Sewell 1992), and the degree of institutionalization of the field(Dorado 2005; Tolbert and Zucker 2012). Jolts or crisis in a field may lead to inconsistency in the existing field that is, institutionalized template fails to address the current situation(Clemens and Cook 1999; Greenwood, Suddaby, and Hinings 2002; Holm 1995b; Oliver 1991a).These Jolts may emerge as a result of social upheaval, competitive discontinuities, regulatory change, adoption of new conventions, technological disruption that affects, agreed upon field norms, rules ,practices etc. As a result ,this gives an opportunity for agency to address this crisis by bringing in new or divergent ideas (Greenwood et al. 2002; Oliver 1992).

Fig 1: Framework for analyzing IEs and their role in SDG audits creation.
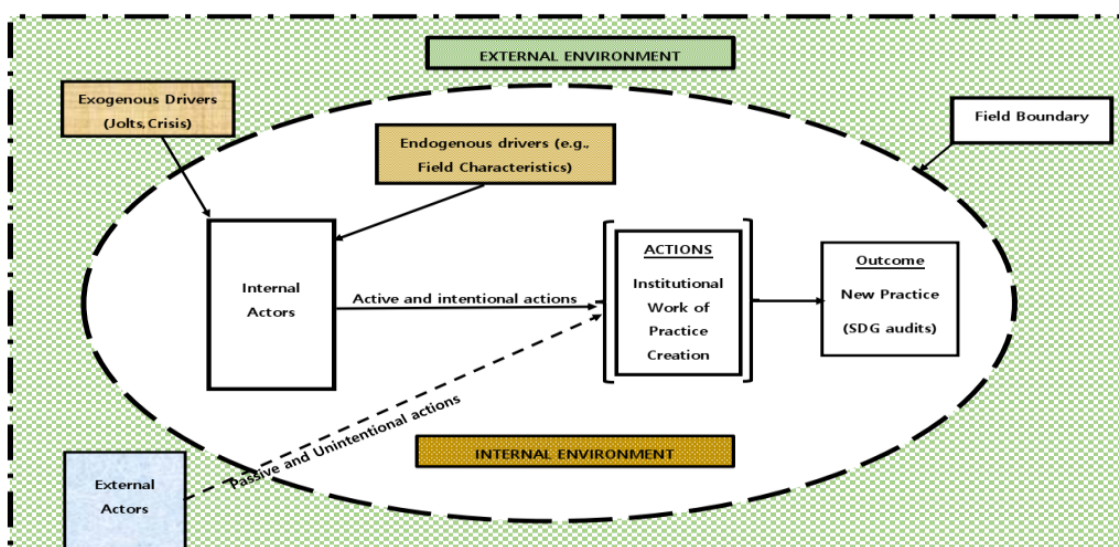
Battilana and D'Aunno (2009), in line with Lawrence, Hardy, and Phillips (2002), argue that a serious crisis that disrupts a field serves as a recipe for institutional entrepreneurship and eventually institutional work. Contesting heroism in institutional creation, some researchers argue that creating a new institution is not that simple , it requires more resources and mobilizing power and that, the process of institutional creation is so broad and so complicated, requiring more resources and power mobilization that even the most powerful ,heroic institutional entrepreneur ,would not be able to do it all alone, thus institutional work for institution creation , requires a collective effort from a broader range of actors(internal and External actors). Actors include both those at the "core" (Institutional entrepreneurs), and "those whose role is supportive or facilitative of the entrepreneurs' endeavors" (Lawrence and Suddaby 2006; Leblebici et al, 1991), In another view, the unidimensional concept of agency(Battilana and D'Aunno 2009a), presents a continuum scale where the two extremes represent the highest level of agency that active agency, and the lowest level of agency, that is passive agency respectively(Emirbayer and Mische 1998a; Oliver 1991b).

4. Methodology

Our research aimed at studying SDG audits by looking at its creation and institutionalization, that is actors involved and the strategies they used in effecting SDG audits creation. We adopted a qualitative approach (Stake 2005). A combination of discursive, relational, and material elements, of institutional work and entrepreneurship were taken into consideration during the analysis. Lawrence and Phillip (2019), argue that in any instance of institutional work all 3 dimensions are present. The very nature of institutions being a cognitive arrangement, makes discourse central to its alteration processes of creation, maintenance, and transformation (Philips et al,2004; Phillip and Malhotra 2008). Most institutional work studies have applied discursive dimensions (Hampel et al 2017). Lawrence and Philip (2019), observed that, management fashion related research has pointed out "the interplay of a range of discursive activities, including defining, and lobbying to achieve political ends, theorizing and mimicking (which imbues material objects with borrowed meaning) to shape technical debates and professionalization and identity construction" (Perkmann and Spicer 2008). With respect to the relational dimension. Lawrence and Philip(2019), posits that the relational dimension of institutional work, has largely being ignored despite institutional work being "inherently political " the relationship between power and institutions is visually ignored (Lawrence and Buchman 2017).Lawrence and Philip(2019),stressed that "once energized , institutional work remains dependent on social relationships because institutions are embedded in and facilitative of those relationships such that   to affect institutions is to affect relationship -entrenching some while disrupting other and creating some anew "

Finally, Lawrence and Philip (2019), in line with Hampel, Lawrence and Tracye (2017), summarized the material dimension of institutional work into "two key points". Firstly, they posited that "material objects can be seen as the product of institutional work in which people embed sets of assumptions about the social world in physical form and then use the objects produced for practical purposes". The second point asserts that material objects are tools utilized by institutional actors, that is "material objects are tools of institutional bracketing in

which actors rely on certain sets of ossified assumptions and beliefs in the form of material objects, to reshape other believes" (Lawrence and Philips, 2019).

4.1. Data Collection

We commenced our data collection by contacting top management at IDI[51], we exchanged emails, which was usually us sending them information requests emails and they replying with documents and links to materials we requested .We later organized a focused group with them on the Creation of SDG audits. The intention of the focus group was to get more insides and corroborating evidence with respect to our key questions of who created the practice and how and why was it created.

Table 2: Archival Data types

Document Type	Number of Documents	Number of Pages
Audit Reports**[1]	37	3996
UN declarations	4	52
INCOSAI Documents	5	90
Meetings on SDG	15	255
Capacity Building activities	17	170
Educational materials (online MOOCs related to the SDG audits)	19	266
Presentations at international conferences	25	375
Professional Journal Publications (from the INTOSAI journal, ECA journal and regional organizations Journals)	92	4692
Articles and Publications from developmental institution, such as GIZ, UNDESA, talking about SAIs and SDG auditing	56	1904
Other Publications from INTOSAI organs (e.g., IDI) and working groups directly involved in SDG audits.	72	4536
UN/INTOSAI SYMPOSIUMs	11	275
Total	**353**	**57435**

1[1] **Includes SDG preparedness and Implementation reports

Much of the data for this study was archival data (See Table 2). This is simply in line with the argument that archival data makes research easily reproduceable, and givthat rigor and transparency (Grodel, Anteby and Holm 2021). Data collected from multiple sources were screened for validity and reliability (Hoque, Covaleski, and Gooneratne 2013; Jick 1979; Miles, Huberman, and Saldana 2014), that is we screened all the documents, eliminating those that are not on the subject matter of SDG audits. One of the most tedious cleanings was done with professional Journal articles. We downloaded journals publications from 2012-2022, the

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[51] IDI is one of the main organs of the INTOSAI charged with SDG audits advocacy and capacity. building activities,

screening process let us to delete those which were found not to be useful to our studies (publications without any article focused on auditing SDG).From 2012 to 2014 and early 2015, the Agenda 2030 were termed "Post-2015 development agenda", this was the key word guiding our search during this period , and post 2015.We could clearly see it being stated in publications, the wordings "Sustainable development goals(SDG)" or " Agenda 2030" , also   this serves as a guide when searching for data on SDG audits post 2015.

The focus group which had in attendance Top management from IDI focused on SDG audits. The members invited were SDG audit experts, training SAI's on performing SDG audits and are involved actively leading the IDI SDG audits initiative. It was a five-man recorded ZOOM meeting that lasted 2hours 10minutes, the recordings were transcribed in 28 pages. During the meeting we discussed on, the purpose of SDG audits, who created it, and how was it created (see appendix A-the meeting guide)

5. Context of SDGs audit

This study seeks to explore the creation of a new public sector auditing practice called "SDG audits". Shortly after the adoption of Agenda 2030, that is, as early as the year 2016, over 80 SAIs had conducted SDG audits[52], aimed at assessing their government's readiness to integrate and implement SDG at the national level. (Guillán Montero and Le Blanc 2019), these audits were aided largely by the committed efforts of the INTOSAI and its organs. For example, the IDI, spearheaded and coordinated different SDG audits related initiatives including the IDI's Auditing SDGs Program. This initiative led to the development of two auditing guides for the two types of SDG audits(Guillán Montero and Le Blanc 2019). that is SDG preparedness audits, and SDG implementation audits respectively. (GIZ P4R,2021).SDG preparedness audits looks at mechanisms put in place by the government to integrate agenda 2030 in the national context, and SDG implementation audits is a performance audits on the implementation of a specific SDG target (Le Blanc and Montero 2020; Rana et al. 2021).

The public sector auditing field is made up of diverse actors, for example, the INTOSAI and its related organs (see appendix A – The INTOSAI organizational chart). The national and supranational audit institutions, external partners such as the UN and UN-related bodies (for example UNDESA), donors and external development partners (e.g., IMF, World bank< OECD), CSO and the public at large.

The urge by INTOSAI to be an accountability voice for SDG, started pre adoption of Agenda 2030(see Table 3 for summary).Due to the strong ties INTOSAI has with the UN nations and other developmental partners, and with its advisory role at the ECOSOC, INTOSAI was aware ahead of time of the forthcoming developmental agenda, this awareness led the INTOSAI especially the General secretariate to launched an advocacy campaign with the aim of SAIs acknowledgment and inclusion in the UN Post-2015, Development agenda.

Key advocacy events pre-adoption if agenda 2030, can be traced as far back as October 2013,

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[52] Before the advent of SDGs, SAIs mainly practices their three traditional audits: Performance audits (PA), Financial audits (FA), and compliance audits (CA).

the then INTOSAI Secretary General, Josef Moser, had a meeting with the then UN secretary general Banki Moon, they both agreed on strengthening collaboration towards accountability for development.

On March 2014 in Berlin, at a symposium organized by the United Nations Economic and Social Council (ECOSOC), on the topic" Accountable and effective development cooperation in a post-2015 era", the General secretary made known the INTOSAI position, He did so again during the 13th Session of the UN Committee of Experts on Public Administration (CEPA), which took place in April 2014 at New York. The General secretariat also contributed a paper to the UN Intergovernmental Committee of Experts on Sustainable Development Financing, and went on to participate in two other UN online discussion sessions on "participatory monitoring and accountability" and "Measuring Progress in MDG achievement and beyond",

These efforts paid off, the ECOSOC president at that time Marin Sajdik, and the UNDESA Under-Secretary, endorsed the inclusion of SAIs in the future UN development agenda (Which today is Agenda 2030), CEPA also in their conclusion to ECOSOC, Included SAIs independence and capacity Building, this also played an important role in designing the Post-2015 Development Agenda. The Secretary General of INTOSAI also participated in the July 2014, ECOSOC High-Level Political Forum, where he advocated once more for the role SAIs can play in Sustainable Development. A cumulation of these efforts influenced the UN to Adopt the UN resolution A/66/209-recognizing the role of SAIs in the UN Post-2015 Development agenda (See INTOSAI Journal July 2014, p38-39).

Table 3: Chronology of Main relevant events towards SDG audits development

Time	Main Relevant event
December 2011	Adoption of UN resolution A/66/209-acknowledging SAI's role in public accountability
October 26, 2013	XXI INCOSAI: extract from the Beijing Declaration "Agreed that INTOSAI should take a role in the United Nation's Post-2015 Development Agenda." (XXI INCOSAI 2013) "XXI INCOSAI releases the Beijing Declaration In the Beijing Declaration, congress participants call in particular for the implementation of the UN Resolution A/66/209 on strengthening the independence of SAIs and expressed support for plans to intensify cooperation with the United Nations in the framework of the Post-2015 Development Agenda."(International Journal of Government Auditing–January 2014)
October 2013	INTOSAI SG meeting with UN SG Banki Moon, to advocate SAIs role in the post-2015 development initiative
March 2013	Post-2015 development agenda inclusion Advocacy by the INTOSAI at ECOSOC (Berlin),
April 2014	UN CEPA 13th Session advocacy for SAIs role and inclusion in the post-2015 development agenda
25 September 2015	Adoption of UN resolution A/RES/70/1 (Agenda 2030)
2016	"The IDI, in collaboration with the Knowledge Sharing Committee (KSC) of the International Organization of Supreme Audit Institutions (INTOSAI), United Nations Department of Social and Economic Affairs (UNDESA) and other partners, launched a capacity development program on "Auditing SDGs" in 2016."
2 to 4 March 2015	23Rd UN/INTOSAI SYMPOSIUM UN Post-2015 Development Agenda: The Role of SAIs and Means of Implementation for Sustainable Development
2016	XXII INCOSAI 2016-Abu Dhabi Declaration - Endorsement of INTOSAI Strategic Plan 2017-2022 and a reviewed INTOSAI Statutes.
2017/2018/2019	Successive versions of the "Auditing Preparedness for Implementation of Sustainable Development Goals Guidance for Supreme Audit Institutions"
September 25, 2019	Moscow Declaration 2019" INTOSAI aims to support SAIs in making a decisive contribution to the success of the 2030 Agenda, and thereby help make a difference in the lives of citizens in accordance with ISSAI-P 12." Guidance on Audit of the Development and Use of Key National Indicators (GUID – 5290) w was endorsed in 2019 at the XXIII INCOSAI in Moscow. The Working group on SDGs and Key Sustainable Development Indicators was created as the successor of the Working group on Key National Indicators (KNI)
2020	IDI's SDGs Audit Model (ISAM)

Source: Developed by Authors based on archival data

5.1. What is SDG audit?

Pre SDG adoption era, the links between developmental policies, programs, and issues, in general, were recognized by experts, policymakers, and other stakeholders, and in some cases, policies were made considering such links, for example, urban waste management (Environmental gaol) and the control of diseases (Health goal). The main difference here is that unlike previous sustainable development goals SDG explicitly acknowledges these links (Le Blanc 2017). SDGs represent the search for a development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report 1987). Sustainable development (Our common Future) requires the integration of 3 dimensions or pillars that is social, environmental, and economic dimensions of development (INTOSAI-Guide 5202 2019, Rio earth Summit 1992, Agenda 21, Kyoto protocol 1997, world Summit on sustainable development Johannesburg south Africa 2002.).

It is very important for policy makers or any decision-making entities to consider these 3 aspects, as has been proven that achieving only one might be at the expense of the others (INTOSAI-Guide 5202). [53] .To attain sustainable growth we need to make a balance between the 3 core pillars or dimensions of SDGs (2030 Agenda) i.e., economic, social, and environmental dimensions as a way to attain the "future we want" ((UNGA 2015)). This act of balancing is usually called the '*wheel of balance concept*'

It is very important not to lose sight of one of them and focuses on the other, for example, an abrupt ban on the use of non-biodegradable plastics without having alternatives or other plans for business and workers who are into manufacturing such plastics. This action may affect the economic dimension, leading to poverty. Auditors should be keen to see if one of these dimensions is having a spillover effect on the other dimension or not.

All 17 SDG goals are of equal importance covering 169 targets, the application or implementation of these goals are left for each government to decide on how to integrate them into their policies, budget, or governance system, by default the attention placed on each target would vary from country to country e.g the energy and resources required in realizing zero hunger that is goal number one (1), will be in a developed country compared to a developing country, this will go a long way to influence the focus of SAI's of a particular country since audit topics are selected based on the fact that they involve "Big Money" and are of great interest and impact to the people.

The SDG audits adopt mainly Performance audit related Logics and the SDG (sustainable development goal) logic (see Figure 2). This is so clear and evident in all SDG audits related audit reports, SAIs clearly referred to the UN agenda 2030, and other national and internal sustainable development documents as sources of their "SDG Logic", The Performance audit logic was inherited from Performance auditing related documents such as ISSAI 3000, ISAM, and IDI-SDG preparedness audit guide, regional and national Performance audit guides. Evidence of the interplay of these logics can be seen illustrated in SDG audit reports, SAIs usually references Sustainable development manuals and documents (containing SD principles

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[53] (The INTOSAI GUID 5202, 2019, was first published in 2004 under the same title "Sustainable Development: The Role of Supreme Audit Institutions".

and good practice guidelines) together with Performance audits guides and ISSAIs as the basis or criteria use in performing an SDG audit, for example SAIs Georgia in 2019, SG preparedness audit report, wrote the following paragraph to state the guiding principles of their audits:

Figure 2. SDG audit's logics

*Source: Author's own elaboration*

"As audit criteria the audit team has used documents elaborated by the UN and INTOSAI, guidelines and better practice examples:

- *The 2030 Agenda -Transform Our World - UN;*
- *Mainstreaming the 2030 Agenda for Sustainable Development - UNDP 2015;*
- *The Sustainable Development Goals Are Coming to Life - Stories of Country Implementations and UN Support - UNDG 2016;*
- *Institutional and Coordination Mechanisms – UNDP;*
- *Breaking the Silos: Cross-sectoral partnerships for advancing the SDGs – ECOSOC;*
- *IDI Guidance on Auditing Preparedness for Implementation of SDGs;*
- *Voluntary National Reviews 2016/2017.5"* **(***SAI GORGIA 2019)*

This mixing of performance audits logics and SDG logics could also be seen in all SDG audits guides, for example figure 3(an extract form the IDI ISAM(INTOSAI IDI 2020) guide) below, depicts the audit process with two main considerations,that is , the compliance with performance audits ISSAIs and SDG related principles (which were derived from the principles of Agenda 2030 as stated by the UN). The guide on SDG preparedness audits also made mentioned of this, bringing to the attention of auditors the core differences between SDG audits and other traditional audits:

"The next question to be answered is, "Is auditing SDGs business as usual, or will these audits require a different approach in order to answer this question, we would like to draw your attention to the principles for implementation of SDGs, mentioned above. This implies that when SAIs audit preparedness, to begin with, and later implementation of SDGs, they need to look at the extent to which these principles have been followed. We have tried to list below some of the implications that this may have for SAIs" IDI (2018, P.47).

Figure 3: Underpinnings of SDG audits
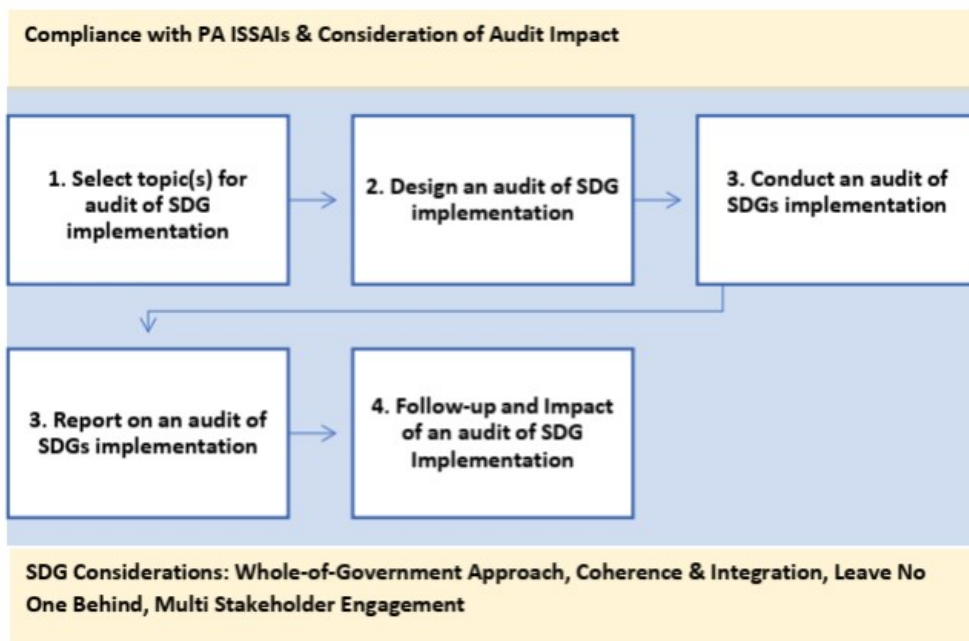
Source: ISAM (2020)

5.2. SDG audits as a practice

SDG audits is in two stages, which forms the two main types of SDG audits, that is Performance Audits of preparedness for implementation of SDGs (hereafter Preparedness audits) and the SDG implementation audits(Bennett 2021).Stage one takes a more ex-ant approach, that is auditing before the implementation, while the latter takes a more traditional ex-post approach , auditing after implementation. The preparedness audits were the first to be performed, and now most SAIs are focusing on auditing individual goals implementation.

INTOSAI/IDI (2019): *"The performance audit of preparedness for implementation of the 2030 Agenda is one of the first responses of SAIs in contributing to SDGs implementation, follow-up, and review. The audit provides an independent oversight on the respective government's efforts in the early implementation of the SDGs. In conducting these audits, SAIs sought to urge national governments into action, if there wasn't any and provided constructive recommendations at an early stage. Audits of preparedness also reminded governments that SDGs are not business-as-usual by looking at issues of integration, coherence, coordination and inclusiveness." (IDI,2019)*

After the preparedness audit auditors can now move to auditing the SDG implementation,

"As SAIs move from the audit of preparedness for implementation of SDGs to the audit of the implementation of SDGs, the most frequently asked question is 'what is an audit of SDGs implementation"? (IDI ISAM 2020)

The above statements from the IDI ISAM follows the natural chronology of every project or plan (that is preparation before implementation) (Grainger-Brown, Malekpour, 2019), it illustrates the order of precedence, first preparedness audits then followed by implementation audits, this has been the de facto standard applied by SAIs: *"INTOSAI recommends SAIs to audit the preparation processes for implementing the SDGs in their countries in the first phase, and then to carry out audits regarding the implementation. In this context, INTOSAI*

organizations carried out guideline works that defined the methodology for auditing the preparation process for implementing the SDGs. Currently, INTOSAI and other umbrella organizations related to SAIs continue their capacity-building works for auditing the implementation of the SDGs." (Turkish Court of Accounts 2020)

Preparedness audit can be defined using its core objectives which are:

"(a) To what extent has the government adopted the 2030 Agenda into its national context?

(b)Has the government identified, and secured resources and capacities (means of implementation) needed to implement the 2030 Agenda?

(b) Has the government established a mechanism to monitor, follow-up, review and report on the progress towards the implementation of the 2030 Agenda? "(IDI, 2019).

Such objectives are like a yardstick guiding SAIs to make 'judgments of what is good or bad performance' (Jones and Pendlebury,1988; p.257; see also Glynn 1987.P. 48) during SDG. These objectives extracted from the IDI Preparedness audit guide were so instrumental in guiding SAIs perform SDG preparedness audits. This could be seen in all the preparedness audit reports we reviewed, in some cases word verbatim as it is on the guide.

The second subtype of SDG audits is ,SDG implementation audits defined by the IDI (2020),as :

"An SDGs implementation is an audit of the implementation of the set of policies that contribute to the achievement of a nationally agreed target linked with one or more SDG targets. It concludes on the progress made towards the achievement of the nationally agreed target; how likely the target is to be achieved based on current trends; and the adequacy of the national target in comparison with the corresponding SDG target(s). An audit of SDGs implementation needs to be conducted using a whole-of-government approach. It needs to conclude on the extent of coherence and integration in the implementation of policies and to the extent possible, the audit could include objectives and questions that allow the SAI auditor to conclude on leave no one behind, and multi-stakeholder engagement."

The above definition highlighted the core concepts to be considered when auditing SDG implementation. Scope-wise, nationally agreed target (interlinks between targets) the emphasis here is that SAIs should be aware of national and international targets, looking at how the attainment of national or local targets sums up to the attainment of international targets, that is ;

- Approach Wise, adopting a whole government approach and the consideration for public policy coherence, these two are core dimensions that distinguish SDG implementation audits from others (Le Blanc et al.,2020).
- Principles wise: the definition emphasizes the importance of two broad principles of agenda 2030 that is Leave no one Behind (LNOB) and multi stakeholder engagements (Le Blanc et al., 2020).

After looking at the definition of SDG audits and its pining logics or principles we shifted to situating it in the public sector audit spectrum, SDG audits are a crossbreed of performance audits and SDG, containing the principles of performance audits and that of SDGs and or agenda 2030(see figure 4).

From figure 4, an SDG audit is a temporal event, which combines the principles of sustainable

Development (SD) and performance audits. These concepts predate SDG audits. SD as a concept existed long before SDG, however, the advent of SDG amplifies its importance amongst stakeholders. The institutionalization of performance audits in the SAI community can be traced as far back as the 1970s (see Guthrie and Parker 1999), while that of sustainability although existed before 1987, become popular because of the 1987 Brundtland report (Redclift 2005), and the SDG audits was born immediately after the adoption of the agenda 2030(A/RES/70/1-2015). One thing is certain, SDG audits will cease to exist post-2030, while performance auditing practice and SD concept will continue into the new post-2030 developmental agenda, however, the impact on SD and Performance audits will remain and will serve as a guide towards addressing the post-2030 developmental agenda. We can see the impact of SDGs today in the lives of public sector auditors. They are not only auditing SDGs but are advocates of SDGs and are structuring the way they operate to an SDG oriented one.Today SAIs use SDG in everything they do, be it auditing and routine activities like office management expenses (e.g., checking their carbon footprints).

Figure4: SDG audits in Time
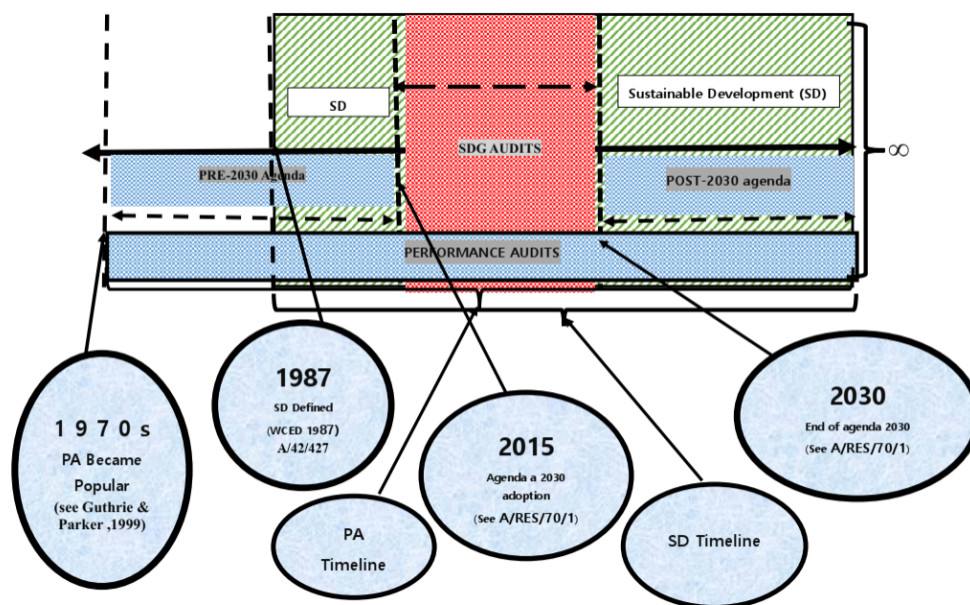
Source: Authors

Although SDG audits generally takes on a performance audit approach ,it is worth noting that auditing SDG may require a combination of skills and methodologies from all three audit types that is financial, compliance and performance audits, however it is recommended that a performance audit should be the main approach while the others financial and compliance audits should act as supporting methodologies(INTOSAI/IDI 2019),

6. Case Analysis

6.1. Actors involved.

Zietsman and Mcknight (2010) argued that iterative nature of institutional work serves as evidence that institutional creation, maintenance and or disruption are rarely a unilateral effort, this is true with the case of SDG audits. As confirmed by IDI, SDG audits resulted from a collective effort of both internal and external actors. Internal here refers to INTOSAI, it's different organs and individual SAI's(See figure 6), while the external partners ,includes , the UN, and UN agencies (e.g. UNDESA,UNCEPA), Donor organizations (e.g. World Bank), developmental organizations (GIZ,OECD) and others whose dominant logic is not auditing,(ISAM 2020).It also worthy of note that some, were traditional partnerships while others were created for the sake of strengthening and building SDG audits capacity.

From an institutional theorist point of view, SDG audits creation was collective and collaborative effort involving actors from both the core and periphery of the public sector auditing field. An example of a core actor here would be the INTOSAI and its different organs such as IDI, KSC. IDI for example, by its modus operandi that is being a "public sector audit practice developer", makes it a key actor and an active participant in the development of any practice in the field of public sector auditing. Other actors whose dominant logic (e.g., CSO, Developmental organizations, donors etc.) of operation was not audits, aided in the creation, some intentionally and others unintentionally, these actors are at the periphery of the field playing a supportive role, examples include the world Bank, OECD, GIZ, UN and its related agencies, and other civil society organizations. However, we should note that the creation and institutionalization of SDG audits reflects more strongly the key values and interest of dominant players (Zietsman and McKnight), examples of such key players are the IDI, WGEA, KSC and the INTOSAI at large.

For instance auditing is the core logics of INTOSAI community, while UNDESA has a broader institutional logic and promotes accountability (external audits) as an SDG implementation tool. In summary this joined efforts could be seen in the drafting of various SDG audits guides. An extract from the ISAM(2020) guide, states that :

"*A group of experts and resource persons with expertise and experience in PA, auditing SDGs, implementation of Agenda 2030 and use of data analytics in auditing have written/reviewed this version of ISAM. We are thankful to the resource persons and experts from the SAIs of India, Malta, USA and DPIG/ UNDESA for their invaluable contribution as core team members and their cooperation with the IDI team in developing this version. We have also received valuable inputs from experts from UN CEPA, INTOSAI PAS, SAI Brazil, SAI Finland, OECD, IISD, UN OIOS, UN Women and Amnesty International." IDI-ISAM (2020)*

It was a similar situation with the drafting of the SDG preparedness audit guide,

*"This guidance has been written by a team of resource persons with experience and expertise in SDGs, performance auditing, INTOSAI plans, the whole-of-government approach, and gender. We would like to take this opportunity to thank the following organizations for participating in the writing of this draft along with IDI: SAI Brazil, SAI India, SAI Indonesia, SAI UAE, GAO USA, PASAI Secretariat, UNDESA, CAAF." (IDI,2018)*

Donors promoting SDG audits related activities can be classified in two, that is internal and external donors, internal donors here we mean actors within the INTOSAI, that is according to the INTOSAI organizational Chart diagram (Appendix B). The types of internal donor- receiver relations can be sub divided into two types, 1) SAI to SAI and INTOSAI organ (eg IDI) to a SAI, and regional organization (e.g. AFROSAI). External donors on the other hand are simply actors not in the INTOSAI organizational chart. They provide donations in monetary terms and in kind directly to individual SAIs or through regional organizations (e.g ASOSAI) or to the INTOSAI capacity building organs such as IDI, KSC etc.

Donors may have a somewhat implicit control over receivers, using their "soft power" that is donations. Borrowing from the charitable given research literature "elite givers usually attaches some conditions to gifts so as to attain a certain objective through the receiver" (Hall 1992, Reilly 1995), Odendahl(1990), calls this "social control". In the case of SDG audits, we found Donors giving funds to SAIs with the aim of helping them effectively carry out SDG audits which in effect goes a long way to improve the implementation of SDG.

Also, SDG capacity building donations were given in kind, "technical support". Various donors may put together financial and other resources to support a single SDG audit project. Summarily, Donations were from 3 main sources, from INTOSAI agencies like IDI, Individual SAIs like SAI Sweden, and external funding from governments, developmental organizations (e.g., GIZ), international developments banks (e.g., World Bank) etc.

Fig 5: The Ecosystem of actors involved in SDG audits.
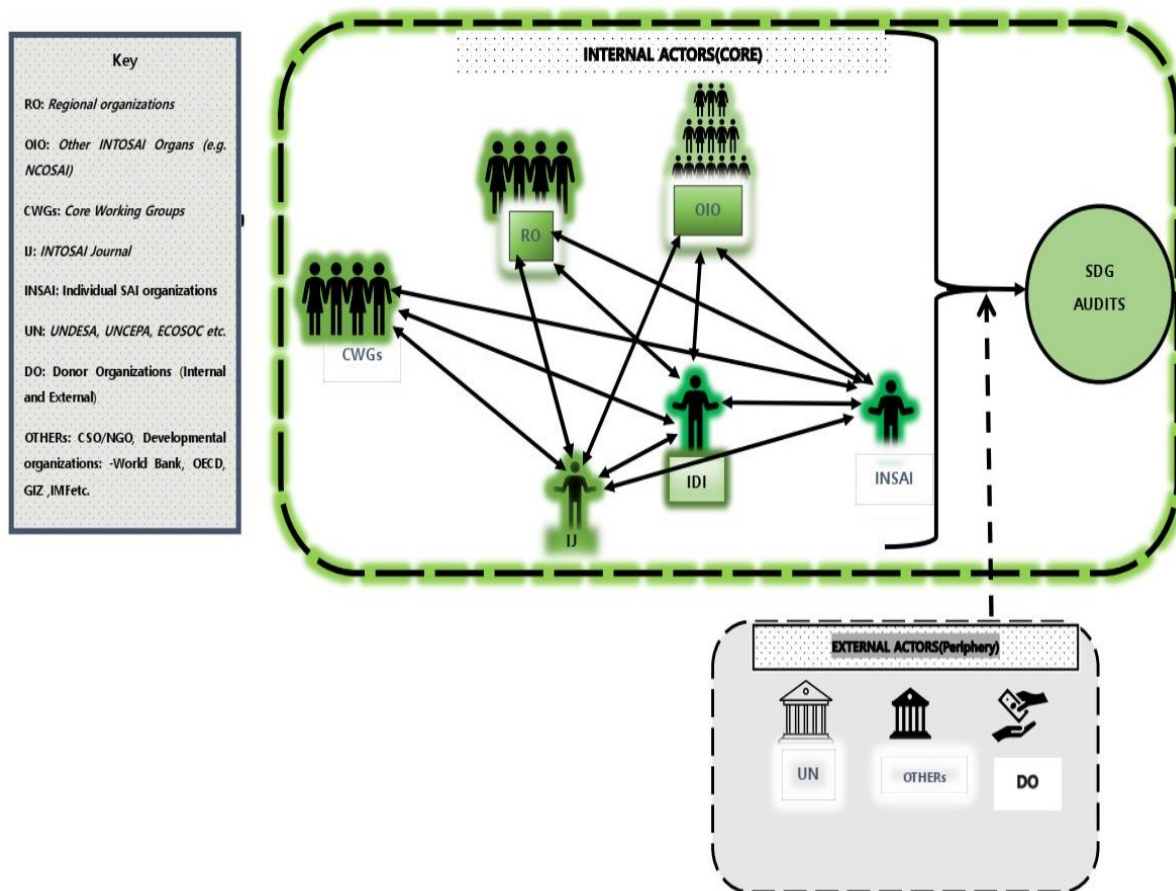
Sources: Author elaboration

Table 4, extracted from the INTOSAI Donor Cooperation website, contains a list of Donors who have signed an MOU with the INTOSAI as of 2022.The INTOSAI Donor Cooperation that is , the body playing a middle man role between the Donors and the Recipients   came into existence upon the signing of the MOU in 2009, at the time 15 donors came together to assist SAIs build capacity , and one of their areas was capacity building on auditing developmental agendas such as the MDGs, Agenda 21, Paris declaration, Accra agenda for action(AAA),in the same spirit , today close 23 donors have signed the MOU , extending assistance towards SDG audit capacity Building.

Donors and developmental partners also were involved in supporting SAIs through training activities geared towards building capacity for auditing SDGs for example,

"The GIZ programme supports AFROSAI and its language subgroups, technical committees and working groups in the fields of public financial control and the auditing of public institutions. The General Secretariat in Yaoundé is supported in its organisational development and the preparation of environmental audits. Furthermore, AFROSAI is supported in

developing a regional methodology of SDG auditing." **(IDC website)**[54]

In summary fig 5, depicts the ecosystem of actors, internally, the INTOSA and it's related organs, such as working groups, regional organizations, specialized agencies such as the IDI, KSC and individual SAIs, while externally actors were from the UN and its related agencies, developmental partners who sometimes are part of the donors, and the Civil society Organization. This combination of actors led to corporations in different capacity building activities, advocacy and support towards SDG audits. This was evident in the development of the two manuals guiding SDG preparedness audit and SDG implementation audits[55].

Table 4: List of External Donors who have signed an MOU with INTOSAI

N.	Organization	N.	Organization
1	African Development Bank	13	International Monetary Fund (IMF)
2	Asian Development Bank	14	Ireland
3	Australian Agency for International Development	15	Islamic Development Bank
4	Austrian Development Agency	16	Netherlands
5	Belgian Ministry of Foreign Affairs, Foreign Trade, and Development Cooperation	17	Norway (Norad)
6	Canada (GAC)	18	OECD
7	European Commission	19	Sweden (Sida)
8	French Ministry of Foreign Affairs	20	Switzerland (SECO)
9	GAVI Alliance	21	United Kingdom (Department for International Development)
10	Global Fund	22	USAID
11	Inter-American Development Bank	23	World Bank
12	International Fund for Agricultural Development (IFAD)		

Source: INTOSAI-Donor Cooperation website[56]

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[54] for more details about donors and their donations towards SDG audits see appendix D, an extract from the INTOSAI donor cooperation websites, it gives key information about Donors and their donation activities with respect to helping SAIs perform SDG audits.

[55] Preparedness audit manual(INTOSAI/IDI 2019) and the ISAM(IDI 2020)

[56] *https://intosaidonor.org/who-we-are/background/)*

Key external actor like, the UN, has been at the helm of international advocacy, one of such efforts was during UN/INTOSAI symposium, specifically the 23rd Symposium which was dedicated entirely to discuss SAIs role in SDG implementation. Also, during the High-Level Political Forum (HLPFs) together with INTOSAI and other partners advocacy Sessions were held to present the work and role of SAIs to the international community. UN through different publications such as resolutions, reports etc.   has been "vocal" about its support for SAI's role in sustainable development accountability, such advocacy gives the practice of SDG audits the international legitimacy it needs.

Within the INTOSAI community, great cooperation could be seen in numerous arenas, be it knowledge sharing on SDGs, drafting of SDG guides or other institutionalization activities, for example the cooperation between SAI Netherlands and seven other SAIs from MENA region through Cooperative audits, and the lessons learned from the audits provided great insights to the drafting of the SDG Preparedness audit guide:

"In the UN Resolution on Sustainable Development, the heads of governments recognised that the ambitious goals and targets could be achieved only with a revitalised and enhanced global partnership. In this context, the cooperation programme between the SAIs in the Middle East and North Africa (MENA) region and the Netherlands Court of Audit is an example of good practice. In the autumn of 2016, a five-year cooperation programme was launched between the SAIs of Algeria, Iraq, Jordan, Morocco, the Netherlands, the Palestinian Authority and Tunisia. The name of the programme is Sharaka, which means 'partnership' in Arabic. As part of this programme, each of the SAIs conducted a Government SDG Preparedness Review in accordance with the seven-step INTOSAI model." (SAI NETHERLANDS 2018)

We argue that one of the main reason SAIs became so involved and working with other partners both within and outside the SAI community was due to the great responsibility and expectations placed on them from different Stakeholders. At the top we have the UN through their different resolutions (e.g., A/69/228) pre-2015 development agenda adoption, stating the role SAIs can play in the post-2015 development agenda. During several international conferences and forums SAI partners Such the ECOSOC, UNCEPA, while advocated for SAI by acknowledging the role they can play in the implementation of SDGs, indirectly raised the expectations from stakeholders. During the 23rd UN/INTOSAI Symposium (2015), on the Theme "UN Post-2015 Development Agenda: The Role of SAIs and Means of Implementation for Sustainable Development stakeholders expressed great expectations in SAIs with respect to SDG accountability. Representatives from civil society organizations representing Citizens, Parliament representing legislative bodies, the United Nations, donors, and development partners all expressed their expectations in SAIs and INTOSAI with respect to SDG accountability.

"The participants of the Symposium have intensively worked on the Role of SAIs in the UN Post-2015 Development Agenda and the Means of Implementation. In detail, they have elaborated on: The Expectations of SAIs by the development partners and citizens regarding Sustainable Development; The Pre-requisites for SAIs to Effectively Engage in the Post-2015 Development Agenda, and fulfil the SDG monitoring and assessment expectations articulated most prominently by the Member States in A/69/228," (23rd UN/INTOSAI Symposium report,

2015)

These expectations increased the pressure on SAIs to device new strategies and appro aches that will match the demands of auditing universally accepted goals such as SD Gs, thus leading to SDG audit creation.

6.2. Institutional work carried out.

Based on the methodology above, the analysis took into consideration the actors involved and institutional work caried out

6.2.1. Advocacy

Advocacy was a joined effort from both internal and external actors. Internal actors, led by the umbrella organization INTOSAI. One of its main priorities is centered on advocating and supporting SAI's work. In its last two strategic plans i.e., "INTOSAI STRATEGIC PLAN 2017- 2022" and "STRATEGIC PLAN 2023-2028" adopted at the 22nd INCOSAI 2016(Abu Dhabi) and 24th INCOSAI 2022 (Rio de Janeiro) respectively they clearly indicated INTOSAI's commitment to advocate and support SAIs towards SDG audits.

As argued by Lawrence and Suddaby (2006), advocacy is a means through which marginal actors can obtain the initial legitimacy they need to influence an institution. INTOSAI, through its working groups and Regional Organizations, supports its member SAIs' efforts to play a key role in promoting and supporting high quality, and relevant audits of national initiatives leading to the achievement of the 2030 United Nations (UN) Agenda for Sustainable Development. INTOSAI and its various organs have spearheaded the advocacy work at the international stage. They do so by strengthening existing relationships and creating new ones with SDG stakeholders.

The INTOSAI , started advocating for SAIs role in SDG implementation pre-2015 , during this time their advocacy work was more focused on lobbying(Suchman 1995), stakeholders to acknowledge and consider SAIs as key stakeholder in SDG implementation. INTOSAI's organs such as then IDI, using techniques of social suation, were able to mobilize political and regulatory support, they did so by organizing events, such as workshops where both political and regulatory actors would converge giving them an opportunity to advocate for SDG audit.

"At the global level INTOSAI has committed to strengthening its long tradition of collaborating with the United Nations. The SDGs provide INTOSAI with a significant opportunity to deepen further this relationship and ensure that the SAI community contributes a valuable voice at global, regional and sub-regional levels on matters relating to the independent audit contributions SAIs can make to the 2030 Agenda for Sustainable Development" (INCOSAI 2016)

At the INTOSAI Development Initiative (IDI), we started by bringing together SAI leadership, UN representatives and key state and non-state actors to create awareness and advocate for the role of SAIs in the 2030 Agenda. At the joint meeting of IDI and the United Nations Department of Economic and Social Affairs (UNDESA) in 2017, SAI leaders called for governments to give their institutions a 'seat at the table'. Since then, the SAI community has come a long way in contributing to the 2030 Agenda by providing independent, external

oversight on SDG preparedness and implementation. (Archana Shirsat Deputy Director General INTOSAI Development Initiative)

External actors[57] have been so instrumental in making SDG audit popular, they do advocacy using mediums such as presentations at international conferences, publication of good practice materials, working papers [58]etc. The UN and its related organs such as UNDESA, played a great role in advocating for SAIs, they started advocating for SAIs recognition as a key player in SDG accountability even before the official adoption of Agenda 2030.The below extract from the 23rd UN/INTOSAI symposium report illustrates this:

"Welcoming the resolutions of the Economic and Social Council (ECOSOC) of 2011 and 2014, acknowledging the indispensable role of supreme audit institutions (SAIs) and related capacity-building in holding Governments accountable for the use of resources and their performance in achieving development goals, and calling on Member States to give due consideration to the importance of the independence of SAIs in the elaboration of the Post-2015 Development Agenda;" (23rd UN/INTOSAI Symposium,2015)

Advocacy work done by the UN can also be envisaged in various General Assembly resolutions, before the adoption of SDG, they had adopted resolutions which acknowledged SAIs role in developmental goals and encouraged governments to support SAIs in their audit work of auditing agenda 2030 implementation[59], For instance the below extract from the UN resolution A/RES/69/229[60] Adopted on the 19th of December 2014:

"…Encourages Member States to give due consideration to the independence and capacity-building of supreme audit institutions in a manner consistent with their national institutional structures, as well as to the improvement of public accounting systems in accordance with national development plans in the context of the post-2015 development agenda.**". (A/RES/69/229)**

Most of the time advocacy activities were hybrid that is both internal and external actors converge to advocate for SDG audits.The UN/UNTOSAI symposium is one of such platforms where collective advocacy occurs.

For example, from the 2nd to the 4th of March 2015 the 23rd UN/INTOSAI symposium was held in Vienna on the theme "UN Post-2015 Development agenda: the role of SAIs and means

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[57] For example, external actor such as "Development partners are often well placed to collectively act as advocates for the SAI in discussions with such partners – particularly where improvements to an SAI's capacity depend on factors beyond its own direct control" (OECD 2012)

[58] for example UNDESA has published the following in its working paper series;" the role of external audits in enhancing transparency and accountability for the sustainable development goals" https://desapublications.un.org/working-papers/role-external-audits-enhancing-transparency-and-accountability-sustainable

[59] At this time, it was cold post 2015 development agenda.

[60] **https://sirc.idi.no/document-database/documents/united-nations-publications/5-un-resolution-69-228/file**

of implementation for sustainable development". In attendance were actors representing governments for example, the secretary general of the Austrian Federal ministry of foreign affairs, international organizations representing the legislature for example the Inter-parliamentary union (IPU), the World Bank ,Austrian development agency representing developmental partners ,and also other UN organs such as UNCEPA and CSOs were all present during the symposium. While expressing their demands to SAIs with respect to SDG implementation, they acknowledged the potential impact of SAIs audits on the implementation of SDGs, thus implicitly advocating for SDG audits.

6.2.2. Defining

The degree of legality and legitimacy of an institution can be influenced by its definition (Boon et al,2019). According to Lawrence and Suddaby (2006), the most common way of defining a new institution is through the creation of 'constitutive rules' (Scott 2001), that is, rules that enable rather than constrain actors. Defining is so important since it serves as a prerequisite for advocacy. Actors can only advocate for a clearly defined institution of practice, that is a practice where the boundaries and scope of applications are clearly defined. Other institutional works such as standardization, accreditation etc. are highly dependent on how an institution is defined(Lawrence 1999; Thomas B. Lawrence and Suddaby 2006b; Russo 2001).

With respect to SDG audits, the most prominent case is the four-point approach (see figure 8) which according to the INTOSAI strategic plan 2017-2022, under the Crosscutting priority 2: "contributing to the follow-up and review of the SDGs within the context of each nation's specific sustainable development efforts and SAIs' individual mandates", will help SAIs support the implementation of SDGs.

The four-point approach helps define SAIs activities towards SDG implementation, it does so by giving ways in which SAIs can integrate sustainable development into their core activities of planning and conducting audits as well as into their daily operation. This approach touches on both what SAIs do and how they operate. On what SAIs do, it recommended auditing the two phases of SDG implementation, that is auditing government readiness and the actual implementation. On how they operate, It focuses on activities geared towards gaining legitimacy in the eyes of stakeholders. Here SAIs are called upon to be role models reorienting their work and operations around SDGs, that is making it become part of their DNA. This can be envisaged in both SAIs audits and non-audit activities. Today almost all audits be it SDG related or not, SAIs are advised to audit using SDG principles as a yardstick:

"Taking SDGs into account when planning new performance audits is key to improve the impact of SDG PA results." (INCOSAI 2016)

In terms of non-audit activities, SAIs are engaging in sustainability self-evaluations such as checking their carbon footprint, tree planting activities (see figure 6), advocacy work towards gender violence and gender equality. These activities are reported and presented in most SAIs annual reports.

"This year was marked by the 30th anniversary of the European Organisation of Supreme Audit Institutions (EUROSAI). To commemorate this occasion, the Turkish Court of Accounts, which is the current chair of the EUROSAI, created a Memorial Plantation Area in Ankara, consisting of different tree species. 50 of the planted trees symbolise the EUROSAI member states and

their deeply rooted past, long-lasting cooperation and joint achievements. It is a great honour that one of the trees carries a memorial plate of the Slovenian Court of Audit, which already in 2018 planted a tree in front of its building by donations of its employees. Other trees are dedicated to former presidents of the EUROSAI and all its working groups'' (EUROSAI 2020)

Figure 6: A certificate acknowledgment for planting trees

Source: Court of Audits of the Republic of Slovenia's website[61]

In summary, this INTOSAI 4 points approach, guides SAIs scope of activities with respect to SDG auditing and implementation. Also defining work was also done using good practices publications and guides, the guides on SDG preparedness and SDG implementation audits respectively clearly explains and define what is SDG audits explains with example both the scope and the process involved (explained in figure 8).

An extract from ISAM (2020), defined SDG audits in terms of its scope and principles. This was also the case with the SDG implementation audit guide. These definitions were at the core of these guidance documents which serve as de-facto standards for SDG audits.

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[61] *https://www.rs-rs.si/en/public-media/news/news/to-celebrate-the-30th-anniversary-of-eurosai-also-a-memorial-tree-of-the-slovenian-court-of-audit-pl/*

Figure 7: INTOSAI   4 approaches to SDGs (INTOSAI Strategic Plan 2017-2022)
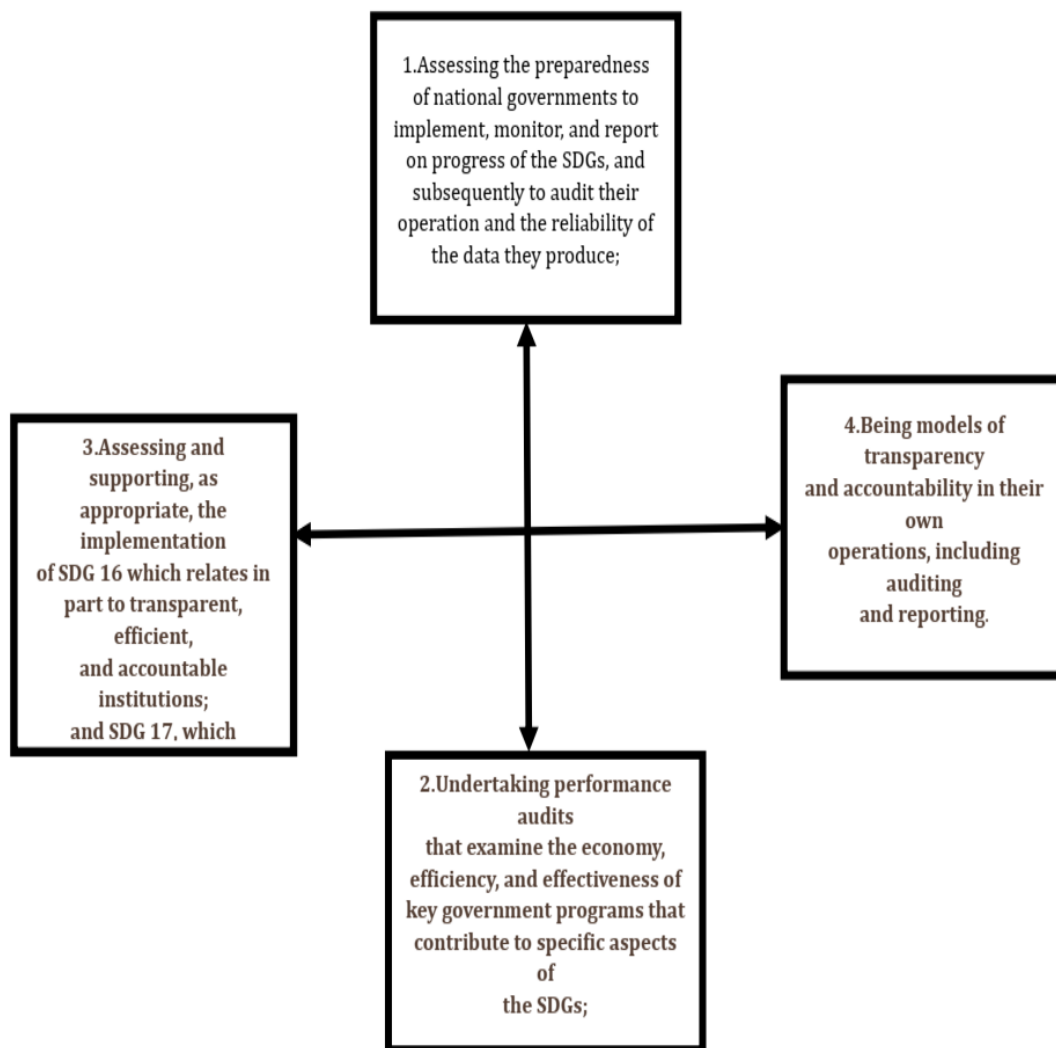
Source: Compiled based on the INTOSAI Strategic Plan 2017-2022[62]

6.2.3. Theorizing

Advocacy alone does not translate to legitimacy to practice in a new field, a redefinition or modification of an abstract system of knowledge is required(Covaleski, Dirsmith, and Rittenberg 2003)

Theorizing is a very important step when creating an new institution, it enables acceptance with less contestation, to an extent theorization affects the level of legitimacy a practices gets (Lawrence and Suddaby 2006b).In other words it enables ease of acceptance(diffusion) and gives legitimacy to a practice (Greenwood , Suddaby , and Hinings,2002;Strang and Meyer 1993). Through theorization , institutional roles and practices are abstracted "into

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comprehensive and compelling theoretical models", which facilitates institutional change and the eventual diffusion of those roles and practices (Greenwood et al. 2002; Lawrence and Suddaby (2006a) , posited that naming of a new concept or practice is the very first step in theorizing ,from which other theorizing proceeds from, In our case they named it" SDG audits" which implies a performance audit for SDG related goals The core auditing logic in SDG audit is the performance audits logics, however   for the sake of distinction and ease of understanding of the practices , they used the name "SDG audits", normally one would not be wrong by calling it performance audits for SDG preparedness or SDG implementation audits however for the sake of simplicity and ease of adoption it was named as SDG audits . In theorizing the new practice of auditing SDGs, actors coined out two sub-types of audits based on the SDG implementation procedure, that is preparation and implementation processes. Auditing the first step of SDG implementation i.e., looking at how prepared the government is in terms of to what extend SDGs have been integrated into national goals or plans, what resources and capacities available for the realization of these goals and finally what review and follow up mechanism available. This first step was named this "SDG preparedness audits", while the actual implementation which focuses on specific goals and targets was named SDG implementation audits. Together they are called "SDG audits". Each type of audits are defined, in terms of approach and methodology. Figure 8 is a definition extracted from the SDG implementation audit from ISAM (2020).

Based on these categories or types of SDG audits, actors came together under the leadership of IDI and KSC, to develop guides which loosely serve as standards for SDG audits. The first guide through a collective effort and based on past experiences of SAIs, was developed to help auditors perform SDG preparedness audits- "Guidance on Auditing Preparedness for Implementation of the SDGs", similar initiative was led by IDI for the development of ID's SDGs Audit Model (ISAM).Aguide for SDG implementation audits. These efforts so far have been so effective in spreading and institutionalizing the practice. Looking at Appendix E extracts from SDG preparedness audit reports, the audit objectives were all similar (a sign of standardization) and sometime extracted word verbatim from the SDG preparedness audit Guide.

Figure 8: SDG implementations audits definition.

Audit of SDGs Implementation - Definition

An **audit of SDGs implementation** is an audit of the **implementation of the set of policies** that contribute to the achievement of a **nationally agreed target** linked with one or more SDG targets.It concludes on the progress made towards the achievement of the nationally agreed target; how likely the target is to be achieved based on current trends; and the adequacy of the national target in comparison with the corresponding SDG target(s).

An audit of SDGs implementation needs to be conducted using a **whole-of-government approach**. It needs to conclude on the extent of **coherence and integration** in the implementation of policies and to the extent possible, the audit could include objectives and questions that allow the SAI auditor to conclude on
- **leave no one behind**; and
- **multi-stakeholder engagement**.

Source: ISAM (2020)

Also in theorizing a new practice, actors strive to specify why the existing practice(s), fails to address the current institutional demand, and complete the process with a justification of why the new institution(in our case SDG audits), is a solution to the problem(Tolbert and Zucker 2012).Advocacy messages on SDG audits have been geared towards, convincing stakeholders why SDG is the perfect to for SDG accountability.

SDGs audits by its definition gives reasons why existing practices were not perfectly suited to handle SDG's thus the creation of SDG audits a performance audit which considers the principles of agenda 2030, serving as a square peg in a square hole. For instance, f concepts such as leave no one behind were absent in existing auditing practices.

6.2.4. Vesting

Vesting is a common practice in established fields such as auditing and law (Baron et al 1986). In the case of SDG audits institution, actors were passive in nature that is they were not acting to intentionally create a new practice, but their actions go a long way to support the institution of SDG audits. In this study two sources of property rights where envisaged, the first category we called it direct vesting, that is it vesting through audit acts Or laws, granting SAIs the mandate to perform SDG audits, to an extent gave SAIs the legitimacy they needed (Le Blanc and Montero 2020).

Since SDG audits is considered as a type of Performance audits, SAI's performed the audits under mandates given to them by existing audit acts or laws. This was evident in all the audit reports that we reviewed. Statements referring to the law or act giving them the mandate to perform such an audit are usually found in the first few pages of the audit report. The statements bellow illustrates that:

""I have the honour, in accordance with Article 187(2) of the 1992 Constitution of Ghana and Section 13 of the Audit Service Act, 2000 (Act 584) to present to you a performance audit report on Government of Ghana's Preparedness for Implementation of the Sustainable Development Goals." (SAI GHANA 2018)

Some SAI's quoted recently updated audit Acts which includes a clear SDG audit mandate, this type of vesting we called it urgent or emergency vesting. For example, this was the case with the SAI of Bhutan, as envisaged in this extracted section from the SDG's preparedness audit report states.

".... "As required under the Constitution of the Kingdom of Bhutan and the RAA's Strategic Plan 2015-2020, the RAA had conducted 'Performance Audit on Preparedness for implementation of Sustainable Development Goals (SDGs)........ Enclosed herewith, please find a copy of Performance Audit Report on the "Preparedness for implementation of Sustainable Development Goals". The Royal Audit Authority (RAA) has conducted the audit as mandated by the Constitution of Kingdom of Bhutan and the Audit Act of Bhutan 2018.". (RAA 2018),

The audit act specifies in word verbatim the audit of sustainable development goals (SDGs) , from Section 82 of page 29 of the 2018 audit act.

"82. Conduct any other theme-based audit including, audit of sustainable development goals, gender-

based audit, multilateral accords, agreements, convention, protocols and may embrace emerging audit approaches as deemed appropriate." (Audit Act of Bhutan 2018/82, p.29)

Existing Audit acts or Laws pre-2015, do grant general mandates on performance audits which extends to conducting *Pre-audits*(OECD 2016), which by nature is similar to SDG preparedness audits (IDI-SAI PMF 2020), since it is audits pre-implementation activities or plans. Post audits or ex-post audits which is the traditional audits, is a suitable approach for SDG implementation audits.

"According to Global Survey responses, most SAIs have the mandate, capacity and willingness to audit implementation of the SDGs or national preparedness for SDG implementation" IDI-Global Stocktaking Report-2017)

The second type of vesting, we called it indirect vesting or *De Facto Property rights (De facto Vesting),* that is vesting from international convention or claims made by international organization such as, UN, INTOSAI, world bank, OECD etc., asserting that SAI's have the legitimacy and right to carry out SDG audits. Prior to the adoption of the SDG, the UN for example adopted the General Assembly resolution A/RES/69/228. This resolution calls on member states to support SAIs in terms of granting them the independence they need in auditing SDG. The resolution also acknowledges and confers legitimacy to SAIs as key stakeholders in SDG implementation accountability that is SDG auditing.

6.2.5. Constructing Identities

Lawrence and Suddaby (2006), asserts that the construction of identity is a very important institution work, these assertions supported by the argument of Bourdieu and Wacquant (1992), argues that, identity describes the actor's relationship to the field or institution.

The most common new identity created because of SDG audits, is somewhat generic it's a common fashion in public sector auditing institutions, like in the case of Performance auditor, financial auditor or compliance auditors, such audit type-specific names or titles are yet to be seen common in Sais. However, group names have been attached to teams performing SDG audits, sometimes generically they are called the SDG audit team, implying a team with training and capability to carryout SDG audits. Despite the less popularity of designating an individual with the Title of "SDG auditor", an out-outlier case is that of SAI Canada, which has an office with specific focus on auditing environmental and sustainability items, and this office has its mandate from the Auditor General act. Section 15: Staff of the Auditor General.

"15.1 (1) The auditor General shall, in accordance with the public service Employment act, appoint a senior officer to be called the Commissioner of the Environment and Sustainability Development who shall report directly to the Auditor general.

(2) The commissioner shall assist the auditor general in performing the duties of the Auditor General set out in this Act that relate to the environment and sustainable development" (Auditor General Act (R.S.C.,1985, c.A-17), last amended 2022-07026)

The idea of creating a new identity might have been affected by the fact that SDG audits is currently practiced by formally performance, financial or compliance auditors.

6.2.6. Constructing Normative networks

Power (1996), posited that expertise legitimacy claims requires the construction of networks of support that is for auditors to make expertise claims in a particular area they need to be supported by a stable and solid network(Gendron, Cooper, and Townley 2007b)

Both empirical and practice literature asserts that a SAI's effectiveness and impact does not solely depend on its level of independence and audit mandate, but also on its ability to create functional networks with its external environment(stakeholders). Stakeholders such as government agencies, the press, parliament, integrity institutions, and civil society organizations etc. are very important partners (Van Zyl, Ramkumar, and de Renzio 2009). Based on this view of SAIs not working alone and needing the support of external stakeholders (Guillon, Lavin, and Cornejo.,2013) prompted the INTOSAI community to create new commitments and partnerships with key stakeholders for the successful diffusion of SDG audits amongst SAIs.

Most of the current SDG audit related partnerships are with traditional stakeholders or organizations, however new partnerships and commitments on SDG audits were established, just a handful of partners were new or first-time partnerships.

Partnerships were both internally and externally. For example, IDI created the SDG audits initiatives and partnered with internal stakeholders such as regional SAI organizations and individual SAIs for the realization of these initiatives. A representative case is that of the partnership with OLACEFS towards preparedness audit on SDG 5;

"IDI's support also extends regionally. IDI proudly partnered with the Organization of Latin American and Caribbean Supreme Audit Institutions (OLACEFS) to aid member SAIs in auditing national preparedness to implement SDG 5. The publication "Are Nations Prepared for Implementation of the 2030 Agenda?" contains lessons learned from the joint project with OLACEFS, as well as SAIs from other regions." (INTOSAI Journal 2020 spring)

Externally, IDI leveraged existing relationships extended partnerships towards SDG audits with traditional allies such as UNDESA.

"IDI also partners with organizations beyond the INTOSAI and Development Partner communities. In particular during 2018, IDI's partnerships with the following organisations were an essential part of delivering on the IDI Strategic Plan
• United Nations Department of Economic and Social Affairs (UNDESA): Since 2016 IDI has built a strong partnership with UNDESA1 for supporting SAIs in audits of Agenda 2030 and the Sustainable Development Goals.
• Canadian Audit and Accountability Foundation (CAAF): During 2018, CAAF supported IDI's SAI Young Leaders Programme, and the Auditing SDGs programme."(IDI PAR ,2018)

These new partnerships led to great achievements such as, the drafting of SDG audit guide for preparedness and implementation audits.

"This guidance has been written by a team of resource persons with experience and expertise in SDGs, performance auditing, INTOSAI plans, the whole-of-government approach, and gender. We would like to take this opportunity to thank the following organizations for participating in the writing of this draft along with IDI: SAI Brazil, SAI India, SAI Indonesia, SAI UAE,GAO USA,PASAI Secretariat, UNDESA,CAAF."(IDI 2018)

The INTOSAI also created normative networks internally, it did so by creating new organs with focus on SDG and SDG implementation audits, for example in 2019, the working group on SDG and key sustainable development indicators (WGSDG KSDI), Was as a successor of the working group on key national indicators (WGKNI). This new organ has as one of its goals contributing to the implementation of national goals and SDG by enhancing inter stakeholders' communication.[63]

6.2.7. Changing Normative association

As posited by Lawrence and Suddaby (2006), it's an act of reconfiguring connections between a practice and its moral and cultural foundations' audits differentiates itself from existing performance audit practices by adopting the core principles of agenda 2030 that is the core normative foundations of agenda 2030 are enshrined in the SDG audit practice(IDI 2020).

Although SAIs have performed sustainability related audits before, this time around it's a different ball game. Concepts of SDGs were not only to be applied in audits, or the practices but on the institutions (SAIs) themselves. This helps give SAIs legitimacy as it portrays an image of "practicing what you preach". Thus, they're to recommend sustainability good practices to auditees, they themselves require to be an example. This approach was highlighted by the INTOSAI strategic plan 2017-2022, under cross-cutting priority 2, approach 4: *"Being models of transparency and accountability in their own operations, including auditing and reporting"*

This has led SAIs and SAIs organizations to account for SDG related aspects such as gender equality, carbon footprint:

"IDI believes that gender equality is vital for inclusive economic, social and political development. The greater a country's gender equality, the greater its ability to maximize the potential of its entire population. Gender impacts all areas of life and society. There is also a strong correlation between gender inequality and poverty, as well as poor economic growth. Gender equality is also on the development agenda for all countries as goal 5 of the Sustainable Development Goals……. Over the previous years, IDI has made tangible efforts to integrate gender in its work, by having sex-disaggregated indicators, actively seeking gender-balanced participation in programmes and gender- focused initiatives (e.g., Auditing SDG Programme focusing on SDG 5), among others11. IDI now seeks to go a step further by making gender an integral part of its entire Strategic Plan". (IDI-STRATEGIC PLAN 2019 - 2023)

Apart from integrating these normative values, there are also ongoing advocacy works, to help these concepts diffuse rapidly.Worthy of note is the fact that moral values such as gender

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[63] "Activities in Goal 4:

1. Supporting SAIs' efforts in ensuring the inclusiveness of access to up-to-date KSDIs for a transparent public assessment of SDG and national goals implementation progress;
2. Disseminating best practices of monitoring the impact and implementation of audit recommendations related to the achievement of national goals and SDGs;
3. Examining inter-stakeholder communication and public awareness building strategies on issues related to the implementation of national goals and SDGs."WGSDG KSDI – Terms of reference https://intosairussia.org/images/docs/ToR.pdf)

equality had existed before the SDGs, however the adoption of SDGs increased its popularity in the SAI community, and thus today its seen as a commitment that they (SAIs) must take.

"Better integrating gender and inclusiveness issues is a continuous journey. First results of efforts to raise awareness, advise, provide tools, develop necessary documents (including the Gender Strategy), invest in networking and cooperating with partners, have already borne fruit in 2020: ……… Supported by IDI, several SAIs have addressed gender and inclusiveness issues in their strategic /operational plans, in particular in IDI's bilateral support (e.g. SAI Madagascar, SAI Gambia)……………….Communication and advocacy efforts on gender have been strengthened with INTOSAI bodies and regions. E.g.: IDI participated as an observer in the OLACEFS working group on gender and nondiscrimination aiming at developing a gender policy for OLACEFS. IDI presented in a webinar on "Auditing SDG1 with a gender perspective" in one OLACEFS subregion." (IDI PAR 2020)

This has been one of the most important institutional works, mainly performed by the INTOSAI and its organs. Here, SDG audits was clearly differentiated from existing practices by connecting its normative foundation to that of SDGs, giving it a clear direction in terms of how to approach and conduct SDG audit.

6.2.8. Mimicry

In this institutional work, actors leveraged existing sets of taking-for-granted practices, technologies and rules when they are creating a new institution, by doing so it reduces the transition cost from old to new institution or practice, (Lawrence and Suddaby 2006).

The guide on SDG preparedness audit in explaining the skills, scope, and audit process (of planning, conducting, reporting and follow-up), referred to existing ISSAI 3000-Performance Audit Standard, specifically section 63,54,59-for skills,96,99,30,51-55,35-37,25,37,45,104, 106,112,116,136- for the audit process. The Guide simply illustrates how to do performance audits in the context of SDG. The ISAM guide for SDG Implementation audits stated the use of already existing Performance audits and related ISSAI. This manifested into actual practice as we could see in all 60 audit reports, we reviewed referred to Performance auditing and existing standards. Below is an illustrative except commonly found at the first few pages of SDG audit reports:

"The international standards used for the audit are ISSAI 300 Fundamental Principles of Performance Auditing, ISSAI 3000 Standard for Performance Auditing, ISSAI 3100 Guidelines on Central Concepts for Performance Auditing, ISSAI 3200 Guidelines for the performance auditing process and Indonesian Public-Sector Audit Standards of 2017." (SAI INDONESIA 2018)

SDG audits are no different from other audits in terms of the phases involved, this could be envisaged been stated in GUID 5202 page 51

" The standards applied to the conduct of audits looking at sustainability development should be no different than any other audits. Audits of sustainable development issues will require the normal four phases of any audit-planning, fieldwork, reporting, and follow-up. The essential objectives -making a difference, promoting accountability and the use of best practices -remain unchanged."

The SDG audit guide(GUID 5202) itself also recommended using existing standards.

"We recommend that SAIs interweave compliance requirements coming from performance audit (PA) ISSAIs and effective considerations for audit impact in the audit methodology for audit of SDGs implementation……. We recommend using an audit process that complies with requirements of ISSAI 30025 and ISSAI 3000. ISSAI 300 defines general principles, as well as audit process related principles. Both these principles need to be addressed in auditing SDG implementation. In applying PA ISSAIs compliant methodology, a combination of results-oriented and system-oriented approach will be best suited for such audits." (ISAM 2020, P.14)

By using existing standards legitimizes the new practices, thus SAIs were able to easily transfer their performance audit skills to audit SDG, this also enabled massive adoption of SDG audit by SAIs

6.2.9. Educating
Educating is One of the ways in which a new institution or practice can easily be adopted or institutionalized.Actor's carryout "educating work" to teach skills and knowledge required to support the institution (Lawrence and Suddaby ,2006). Educating is a "very important form of cognitive work, in that the creation of a new institution often involves the development of novel practices as well as connecting those practices to control mechanisms".

The education work for SDG audits was done by multiple actors, and often through collaboration between one or two partners. We categorized the educational practices into Vertical, Horizontal, internal, external, and mixed educations. Horizontal here implies peer to peer collaboration (SAI to SAI), while vertical, from an INTOSAI organ (e.g., IDI), to a SAI or SAIs, or internal within INTOSAI, that is an INTOSAI organ to a SAI or regional organization, regional organizations to SAI, SAI to SAI. External depicts education from external partners (e.g., GIZ) either directly or indirectly, directly they may engage with a SAI by providing capacity building activities in form of seminars, workshops, and trainings. Indirectly, usually by financing a capacity building activity (see Table 5).

Most common capacity building activities, includes Conferences, cooperative audits, knowledge sharing events, technical guides, online training including MOOCs. Online training for example has been one of the most widely used capacity building methods, almost all the regional bodies, some individual SAIs and INTOSAI organs like IDI are offering SDG audits related courses.

A website or Hub like popular edtech platforms like cousera was created and named U-INTOSAI. This website hosts other auditing courses to, it also provides links to general courses on SDGs, offered by external organizations. Courses can be taken directly on the website, while others will provide an overview with links to the provider's website.

"University for the INTOSAI Community (U-INTOSAI) is a project created on the initiative of the Accounts Chamber of the Russian Federation as the INTOSAI Chair, aiming at responding to the need of the international audit community to consolidate the activities on capacity building of INTOSAI bodies and individual SAIs. The conceptual framework for the university creation was initially outlined at the 23rd INCOSAI in Moscow in September 2019 as one of the priorities of the Chairmanship of the Accounts Chamber of the Russian Federation in the organization. After preliminary work with the key stakeholders in the field of INTOSAI capacity

building, the project implementation was approved by the 74th INTOSAI Governing Board in November 2020." (U-INTOSAI)[64]

In summary, education is so pivotal, and it is a continuous process. It's one of the areas where actors have and are investing more time and resources on, for example MOOCs and online courses are gaining momentum in the INTOSAI community.Through experiences and good practice sharing events education on SDG audit is being diffused.

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[64] *) https://u-intosai.org/)*

Table 5: Summary Quotes on Educational work[65]

Quotes	Actors	Type of educational work
"The head of the SAI of Chile and the Secretary General of OLACEFS, Mr Jorge Bermúdez, reported on the organization's activities regarding capacity building, which involved coordinated audits, virtual meetings, training courses and studies conducted on the SDGs, citizen participation and good governance" (INCOSAI 2016)	SAI, Regional Organization	Internal, Vertical, Direct
"It was in this spirit that the OLACEFS Capacity- Building Committee and the Special Technical Committee on the Environment, with the support of the German Cooperation Agency (GIZ), decided to create an on-line course about the Agenda 2030 and the role of SAIs in the implementation of the SDGs. The objective is to build the capacity of auditors so they are able to understand the concept and main principles of the Agenda 2030 in general and of the SDGs specifically, as well as provide information that will help in the performance of audits within the framework of the SDGs." *(Minister Augusto Nardes Minister of the Federal Court of Accounts (TCU – Brazil),Chairman of the OLACEFS Capacity Building Committee,2022)*	OLACEFS,GIZ	External ,Direct
"Since 2016, INTOSAI Development Initiative (IDI) and INTOSAI Knowledge Sharing Committee (KSC) have supported seventy three SAIs and one sub-national audit office in different parts of the world in conducting performance audits2 of preparedness for implementation of the 2030 Agenda."(IDI,2019)	INTOSAI organ,SAIs	Internal,Vertical,Direct
"We have all shared our observations and findings on sustainable development and government evaluations with our counterparts from the Netherlands and the six Arab countries. The outcome feels like a success, as we have all learned a lot from each other and found a positive role for each of us in coming up with a definitive guide for INTOSAI, to help our governments plan for the 2030 agenda." (Malika Didouche Head of Chamber of the SAI of Algeria)	SAI to SAI	Internal, Horizontal, Direct
"IDI received earmarked funding from the following organisations: Global Affairs Canada: for ISSAI implementation (including ISSAI-based audits of preparedness for implementation of the SDGs), SAIs Fighting Corruption and SAIs Engaging with Stakeholders,..... BMZ Germany (awarded through the German Development Implementing Agency, GIZ): for SDGs:2030 Agenda for Sustainable Development"(IDI PAR 2020)	INTOSAI Organ, Donors and Developmental Partners	Indirect[66] , external

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[65] A more summarized account of our analysis of institutional work is tabulated in Appendix C.

[66] *indirect because, the funding will be translated into capacity building activities (by IDI) that will help SAIs perform quality SDG audits*

7. Discussion

Our research applied a qualitative methodology and also implicitly used the 3 dimensions of institutional work that is discursive, relational, and material dimension respectively see (see Lawrence and Phillips 2019) as a lens. Concerning the Discursive, we saw the creation of documents, like the ISAM (IDI 2020), which defines and guides the practice. Conferences and seminars were held through which SAIs, "stories"(Experiences auditing SDGs) were narrated (Thomas B. Lawrence and Phillips 2019), on the application and usefulness of SDG audits. Relational dimension was also envisaged, for example the creation of SDG audits, saw the coming together of different actors through formal and informal networks, with a central aim of establishing SDG audits. Finally, on the material dimension we saw activities such as the creation, of new organs within the INTOSAI tasked with SDG, this was for instance the creation of the Working Group On SDGs (WGSDG KSDI) .Lawrence and Phillips (2019) calls such "large material forms". This research approach was applied to answer the following 3 research questions:

R1 What is SDG audits?

R2 Who are the creators of SDG audits?

R3 What are the roles or strategies used by actors in creating SDG audits.?

In answering the first question the study looked at existing guides and manuals, and other documents, on SDG audits. These documents gave insights as to what SDG audits are. Firstly we observed that, SDG audits, serves as a quick fix to the disruption brought by the adoption of SDG agenda 2030.Since the new agenda was grounded with principles such as leave no one behind , whole of government approach , multi-stakeholder engagements, policy coherence and integration, the SAI community came together to device an audit approach that will handle these concepts, thus, the new approach called SDG audits was simply an augmentation of an Existing practice called Performance audits.

Second observation, not just the name but even the methodology, of SDG audit was adopted from the existing performance audit ISSAIs (300,3000), and other existing ISSAI, However the main difference was that while using the performance audits standards, auditors must take into consideration the principles of SDGs, since without these principles of SDG (agenda 2030), cannot be implemented as planned. These observations confirm with arguments raised by scholars, that audits is a vague concept difficult to define (Power,1995), it is an ever evolving field, which like snow ball grows by gathering experiences as time goes by.

Still in line with the first research question, our analysis shows that SDG audits do have the characteristics of a proto institution. For example, we are halfway into the SDG implementation (2016-2022), and yet there is not a single SDG audits ISSAI or an initiative of drafting an ISSAI on SDG audits, instead the INTOSAI recommends the use of already existing ISSAIs.. This indicates temporary of an institution, in this case SDG audits practice. The guide clearly state that SDG audits is a performance audit and recommended Performance audits related ISSAIs, the added ingredients differentiating if from traditional performance audits is that of the strict adherence to SDG principles such as policy coherence, leave no one behind, whole

of Government approach, multi-stakeholder approach (ISAM 2020, Le Blanc and Montero 2020).

The only ISSAI specifically focusing on sustainable development, ISSAI-5130(2004), is largely influenced by international declarations such as Rio Declaration 1992, Johanesburg (2002), WCED (1987), it was revised and renamed as GUID 5202.It gives a general guidance on auditing sustainable development. This post 2015, version (GUID 5202), proofs the timelessness of the SD concept, the guide was not created particularly for auditing agenda 2030 implementation, but to inform public sector auditors to always incorporate the sustainable development logic into their audits (GUID 5202).

Thus, we conceptualize that SDG audits may be bound by time that is 2016-2030, but the underlying principles of SDG which is rooted in sustainability development logic is timeless, it's a concept that has a constant perpetuity timeframe i.e., "Positive infinity". The definition of Sustainable development "development which meets the needs of the present without compromising the ability of future generations to meet their own needs". The phrase "future generation" in it makes it an eternal concept. This implies that SDG like MDG would come and go but they would have an everlasting imprint on established auditing practices (Performance audits). It would be safe to say SDG audits may be a temporal institution (proto institution), created to maintain and established institutional field (performance audits)

The first phase of SDG audits which is preparedness audits (IDI-2020), can be taxonomized as an ex-ante audit, that is audit before the implementation, and this is not a new concept to SAI's. The concept pre-audit can be traced as far back as the first UN/INTOSAI seminar, 1971, Austria. The second type of SDG audits, that is implementation audits, follows the traditional ex-post approach. Before the advent of SDG audits, SAIs have experienced auditing with SDG audits concepts such as whole of Government approach, policy coherence (OECD 2016), however the degree of integration between SDG goals and targets makes it different from any other previous audit experience.

Moving on to the next question which investigates actors involved in SDG creation, we observed that SDG audit was created through a collective action. Some actors were more active than others, especially those whose dominant logic of operation is audit. Actors such as the INTOSAI and individual SAIs were more active than external actors such as developmental partners who usually come in to provide assistance in the form of capacity building for SDG audit and sometimes participate in SDG advocacy (e.g. UNDESA).

The Normative foundations and theorization work was largely done by INTOSAI with expert input and other supports from external partners. The very nature of agenda 2030 requiring multi stakeholder engagement and the complexity of SDG goals meant SAIs needed inputs from external partners to create a fit for purpose practice.

The final question was focused on investigating strategies used by actors to institutionalize SDG audit. Here we applied institutional works as a theoretical lens. Our results shows the application of the various categories of institutional creation work as taxonomist by(Thomas B. Lawrence and Suddaby 2006b).

In summary, the various institutional works led to the growth in acceptance of SDG audits

amongst stakeholders. According to the INTOSAI "sdg-atlas" web page, SDG audit reports rose from 2 in 2017 to over 100 by 2021[67].

Our study concludes that the application of these institutional work practices led to the creation of a temporal or proto institution, that is SDG audits which serves as an instrument to maintain an already existing and established institution (that is performance audit). The motivation of the various institutional work strategies in summary was aimed at creating SDG audit to augment performance audit thus meeting the challenges and complexities of auditing SDG's implementation.

8. Conclusions

The aim of the study was in folds, firstly the focus was to get an understanding of what is SDG audits, secondly, exploring its creation that is, actors involved in creating this practice and the roles or actions they took in creating SDG audits.

This study demonstrates the process involved in the creation of a new public sector auditing practice, by using the lens of institutional theory, specifically, exploring at the interaction of institutional pressures (in the form of jolts-the adoption of Agenda 2030), and institutional entrepreneurs who in turn devise different strategies (Institutional work), to address these jolts. Their strategies were geared towards the creation of SDG audits as an accountability mechanism best suited to handle the challenges involve in auditing a complex phenomenon such as SDGs(agenda 2030), see(Battilana and D'Aunno 2009a; Battilana et al. 2009b; Hardy and Maguire 2012; Thomas B. Lawrence and Suddaby 2006b)

We argue that the creation of SDG audits, to a certain extent, is part of an overall public sector auditing institution's maintenance work, that is to maintain the existing Performance auditing practices. We recall as argued by Lawrence, Suddaby, and Leca(2011) institutional maintenance work has as main objective to help an institution maintain its relevance and effectiveness, especially when its institutional foundations or templates are put to test by a precipitating jolt(Hardy and Maguire 2012). SDG audits is an attempt to help auditors remain the relevant accountability voice or an attempt to maintain their legitimacy in the SDG assurance space.

The advent of SDG agenda 2030 and its logics posed some precipitating jolts that led to current performance auditing or traditional auditing practices wanting. In order to maintain the status quo as the relevant voice and key player when it comes to holding government accountable for their actions towards the implementation of SDG (OECD 2016),.SDG audit was created not to replace existing practices(particularly Performance audits)(Le Blanc and Montero 2020) , but to maintain and reinforce them   to meet the current challenges posed by auditing SDG agenda 2030. Performance audits, being a matured and established field needed to maintain, it's relevance. SDG audits is literally a performance audits with additional considerations of the concepts and principles of Agenda 2030 (ISAM 2030).

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[67] https://www.intosai.org/system/sdg-atlas

Based on this premise we argue that post 2030, the audit "fashion" of sustainability development performance audits will still exist, however a new proto institution or practice just like SDG audits will be created that is any time when a new developmental agenda is adopted. This new practice will take on the nomenclature of the new Developmental goals(agenda)that would be adopted by the UN. These new practices will augment similar existing practices at the time with new principles of the newly adopted developmental goals. (e.g., Post-2030 development goals or Agenda)

Lawrence, Hardy and Phillips (2020), defined proto- institutions as "new practices, rules, and technologies that transcend a particular collaborative relationship and may become new institutions if they diffuse sufficiently." Proto-Institutions are sometimes seen as "unintended by-products of field reconfigurations, which are initiated by a precipitating jolt". SDG audits as a new practice, not yet mature or taken for granted by all stakeholders. Some SAIs are yet to produce their first SDG audit reports or they are completely sidelined and ignored by their governments as key players when it comes to SDG implementation, and accountability. For instance during the Voluntary National review reports, where SAIs were rarely acknowledged or included in this process (Breuer and Leininger 2021)

Our research makes the following key contributions, firstly, we contributed to the growing literature on institutional creation work (Greenwood and Suddaby 2006; Lounsbury and Crumley 2007a; Maguire et al. 2004; Suddaby and Greenwood 2005a; Zietsma and Lawrence 2010; Zietsma and McKnight 2009), maintenance work(Currie et al. 2012b; Dacin, Munir, and Tracey 2010; Thomas B. Lawrence and Suddaby 2006b; Micelotta and Washington 2013; Trank and Washington 2009; Zilber 2009),proto-institution(Thomas B; Lawrence, Hardy, and Phillips 2002; Smolka and Heugens 2020; Zietsma and McKnight 2009), by looking at the creation of an institution (in our case SDG audits a proto institution) aimed at maintaining a status quo (that is existing public auditing practices such as Performance audits). More precisely we differ from (Zietsma and McKnight 2009) findings of actors creating maintenance mechanisms to maintain a created proto-institution, instead, our findings suggest that, in certain situations, especially in a matured public sector auditing field, the creation work of a proto-institutions is usually part of an overall strategy to maintain the established institutional field(in our case performance audits). In this case, the proto institutions eventually dilute into the mature field, strengthening it taken-for-granted template, legitimacy and thus securing its continuity. Our proto institution (SDG audits), is time bound and would not exist post-2030, however, it would embed in public sector auditing practice its principles and logics, this is a similar situation of the NPM, which greatly impacted performance audits, (see Leeuw 1996). Recently, was the case with MDGs, were auditors transfer their experiences in auditing SDGs to prepare them for SDGs audits(Guillán Montero and Le Blanc 2019).

This study also advances our knowledge of how public auditing practices are created, and augmented, particularly how actors react to exogenous change(Battilana and D'Aunno 2009a; Battilana et al. 2009b).Our research shows how different actors partake(Dorado 2005) in the creative work of a new practice, some acted intentionally, for instnace INTOSAI and Its organs(e.g. IDI), by combining different institutional work strategies see(Thomas B. Lawrence and Suddaby 2006b; Perkmann and Spicer 2008b), and others passively supported the work of the "active" actors, for example, external Donors, providing funds for SDG audits capacity building and education work. In summary, SDG audits creation was a collective institutional

entrepreneurship(Jolly and Raven 2015; Wijen and Ansari 2006), where actors convene(Dorado 2005), with different institutional skills and resources(Perkmann and Spicer 2008) at a common ground-"accountability for SDGs", to create a new accountability mechanism for SDG implementation.

Our study is limited in that, it might be difficult to generalize our findings in other settings, such as the private sector, since SAIs operate in a quite different environment, and operate differently when compared to, private sector auditors (e.g., the BIG 4, with a strong commercial logic).Another limitation relates to our methodology, we lacked enough corroborating evidence in the form of in-depth interview with all the stakeholders involved, and we acknowledged that this might cause some bias in our findings.

Despite our limitations, our findings open numerous research opportunities. We call on critical research looking at the methodological aspects of SDG audits, and research investigating the impact of SDG audits on SDG implementation is highly recommended. Currently, some SAIs are still yet to produce their first SDG implementation audits, thus research exploring factors affecting them, that is affecting their efficiency and effectiveness in producing SDG audits is highly recommended. Investigations into why some governments don't consider SAIs very useful in SDG reviews and assessments are also of importance.

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Appendix A: Focus group meeting Agenda

Questions to be discussed.

Brief introduction of participants

Q1) Who are the initiator(s) of SDG audits? What role did your organization play at this initiation stage of SDG audit?

Q2) What factors motivated the creation of SDG audits? How was SDG audits created? (Chronology of key events)

Q3) How different is SDG audit from traditional audit types   (financial, compliance and performance audits)?

Q4) During millennium development goals (MDG) we did not have MDG audits, but after launching of UN SDGs, SDG audits was introduced. Why did this happen? Is this something groundbreaking that would last beyond the 2030 agenda or just an episodic attempt to respond to the UN's call for accountability in SDG implementation?

Q5) What will be the future of SDG auditing? And how do you see the role of your institution in it?

Practical information about the group interview:

- Online interviews held via Teams/Zoom
  Interviews will be audio recorded and processed in compliance with international GDPR rules. The participants have the right to refuse the interview and the recording.
- All interviews are anonymous, and personal data will be anonymized when transcribed. Their personal information will not be revealed in the final documentation (future articles). Their data will be kept just during the information collection phase, than afterwards, these data should be erased.
- A preliminary report of interview will be sent by the research team to all interviewees in the middle of September.

Actors (IE) specific Questions

A) *Mimicry*
How similar is SDG audits to other already existing auditing practices?
Prompt: Based on the above similarities/differences- was/were they motivated by the ease of adoption and use by auditors?

B) *Educating*
What are some of the capacity building or educational activities provided by your organization to help equip SAIs with both the practical and theoretical skills and understanding of SDG audits?

Prompt: Any Upskilling activities – courses/ training?
-seminars/conferences?
-practice manuals /materials?

C) *Advocacy*
What are some of the awareness and advocacy activities carried out by your organization, preaching the message of SDG audits as a key accountability mechanism for SDG implementation?

Prompt: Were there any challenges in making stakeholders to accept SDG as a legitimate practice?

D) *Defining*
What was the role you (your organization) played in developing auditing standards/guides and or documents for SDG audits? Who were the actors that you collaborated with during this process?

E) *New competences*
According to your Organization, Who is an SDG auditor: what are the tasks he/she performs?
Prompt: Do they require different skills from PA/FA/CA?
Prompt: What is the right educational(training) background required for one to become SDG auditor?
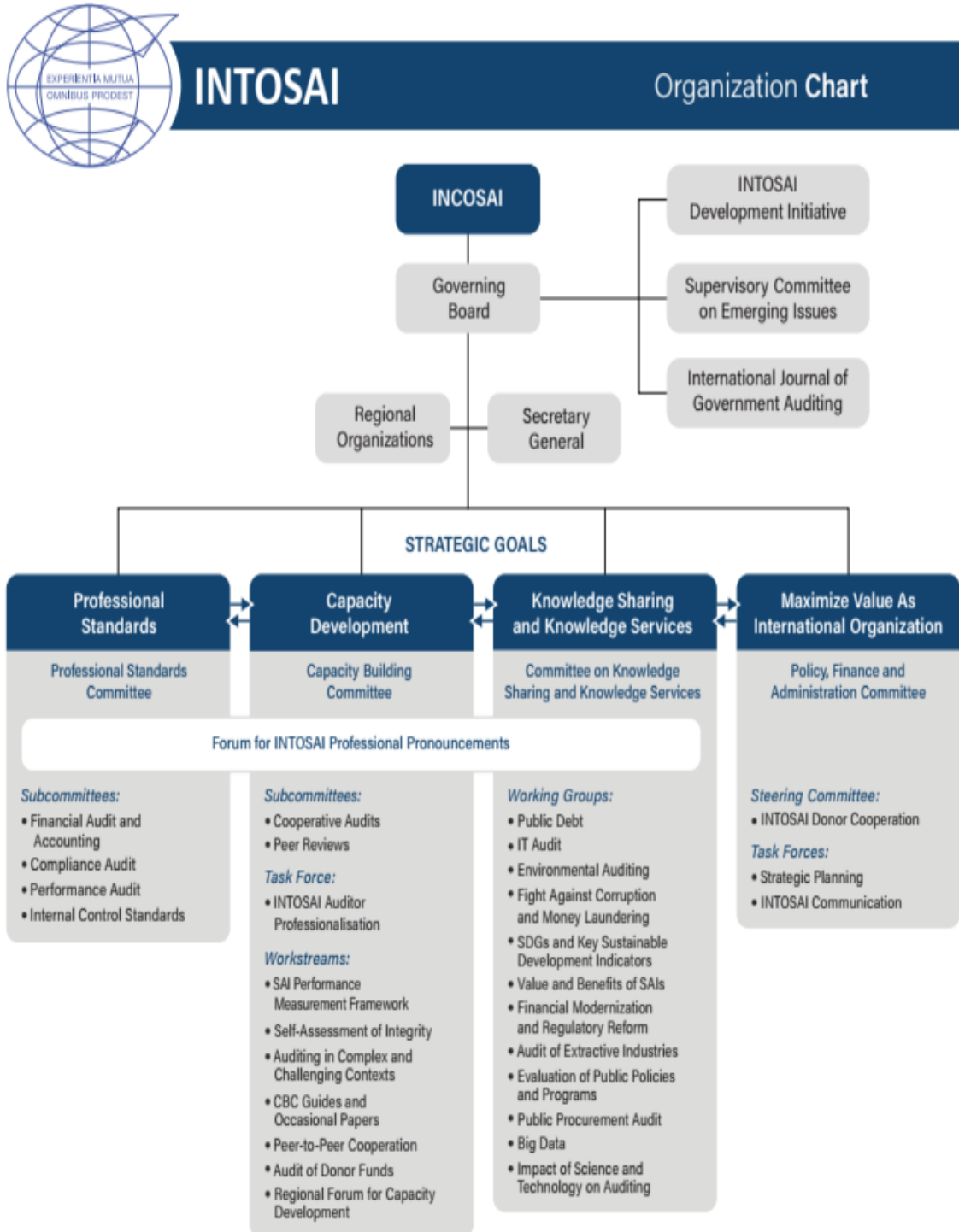Prompt: Did SAI create new positions or job designations as SDG auditor?

F) *Construction Normative networks*
What are of the new alliances that you have created, or old ones reinforced in   relation to SDG audits creation and diffusion?
Prompt: Who are your Internal (within INTOSAI Community) networks and externally networks (outside the INTOSAI community) when it comes to SDG audits Creation and diffusion.

Appendix B: INTOSAI Organizational Chart

INTOSAI — Organization **Chart**

INCOSAI

- INTOSAI Development Initiative
- Supervisory Committee on Emerging Issues
- International Journal of Government Auditing

Governing Board

Regional Organizations — Secretary General

STRATEGIC GOALS

Professional Standards	Capacity Development	Knowledge Sharing and Knowledge Services	Maximize Value As International Organization
Professional Standards Committee	Capacity Building Committee	Committee on Knowledge Sharing and Knowledge Services	Policy, Finance and Administration Committee

Forum for INTOSAI Professional Pronouncements

Professional Standards

Subcommittees:
- Financial Audit and Accounting
- Compliance Audit
- Performance Audit
- Internal Control Standards

Capacity Development

Subcommittees:
- Cooperative Audits
- Peer Reviews

Task Force:
- INTOSAI Auditor Professionalisation

Workstreams:
- SAI Performance Measurement Framework
- Self-Assessment of Integrity
- Auditing in Complex and Challenging Contexts
- CBC Guides and Occasional Papers
- Peer-to-Peer Cooperation
- Audit of Donor Funds
- Regional Forum for Capacity Development

Knowledge Sharing and Knowledge Services

Working Groups:
- Public Debt
- IT Audit
- Environmental Auditing
- Fight Against Corruption and Money Laundering
- SDGs and Key Sustainable Development Indicators
- Value and Benefits of SAIs
- Financial Modernization and Regulatory Reform
- Audit of Extractive Industries
- Evaluation of Public Policies and Programs
- Public Procurement Audit
- Big Data
- Impact of Science and Technology on Auditing

Maximize Value As International Organization

Steering Committee:
- INTOSAI Donor Cooperation

Task Forces:
- Strategic Planning
- INTOSAI Communication

Appendix C: Empirical examples of Lawrence and Suddaby's (2006) forms of institutional work with respect to SDG audits creation

Form of Institutional work		Lawrence and Suddaby's (2006) definition	Illustrative data extracts and supporting evidence
Overtly political work	Advocacy	The mobilisation of political and regulatory support through direct and deliberate techniques of social suasion.	"Furthermore, Mr Liu [The Chairman of INTOSAI] mentioned his activities in promoting the involvement of SAIs in ensuring the successful implementation of the SDGs and referred to his communication with UN Secretary General Ban Ki-moon concerning the inclusion of two indicators in the UN indicator framework measuring the implementation of the SDGs" (INCOSAI 2016) "This 23rd UN/INTOSAI Symposium was held from 2 to 4 March 2015 in the Vienna International Centre. The aim of the event was to specify the position of SAIs with regard to sustainable development as the guiding theme of the Post-2015 Development Agenda by involving the partners and to contribute this position in the further preparation process of the Post-2015 Development Agenda." (Dr. Josef Moser ,2015) "In this process, the co-organizer of this symposium, the United Nations, has a special role to play, as it champions the strengthening of the role of SAIs as well as the promotion of transparency and accountability with full commitment. In this regard, UN Secretary General Ban Ki-moon called for a strengthening of SAIs in his Synthesis Report1. Furthermore, Under-Secretary-General Wu Hongbo underlined in January 2015 that strong and independent SAIs are a key factor for the implementation of the SDGs. Finally, also ECOSOC President Ambassador

			Martin Sajdik explicitly highlighted the importance of independent SAIs for a monitoring and review mechanism..**" (Dr. Josef Moser ,2015)**
			"In her brief summary, Ms Kraker outlined the activities of the General Secretariat concerning the United Nations 2030 Agenda and the Sustainable Development Goals (SDGs), in particular the side-event in the framework of the ECOSOC High-Level Political Forum in New York in July 2016, in which the participants had discussed what possible contributions SAIs could make, as well as the reporting on the implementation of the SDGs." (INCOSAI 2016)
	Defining	The construction of rule systems that confer status or identity, define boundaries of membership or create status hierarchies within a field.	
	Vesting	The creation of rule structures that confer property rights.	Rights to perform SDG audits were largely gotten from already existing laws or acts that confers rights to audits public sector activities in general, i.e., mandates were inherited from existing laws. "I have undertaken a Performance Audit on the Preparedness for implementation of sustainable development goals (SDGs) by the Ministry of Finance and Economic Development pursuant to the Public Audit Act, 2012. In addition to Section 124 (2) and (3) of the Constitution of Botswana, Section 7(1) of the Public Audit Act, 2012, gives the Auditor General the mandate to carryout

				performance audits in the public sector and that Performance Audit Reports are to be laid before the National Assembly by the Minister responsible for Finance." (Letebele Auditor General-Office of the Auditor General SAI BOTSWANA 2019) "In light of the above and in compliance with the Auditor-General's mandate, as detailed in Section 119 (2) of the 1991 Constitution of Sierra Leone, the Audit Service Sierra Leone conducted a performance audit on the preparedness for implementation of the SDGs in Sierra Leone. The audit covered the period between January 2016 to March 2018. The objective of the audit was to assess the 'preparedness for the implementation of the 2030 Agenda'." (**SAI Sierra Leone** 2019) "In accordance with Section 22 (1) of the Auditor General Act 2010, I have the honour to submit my special review report entitled 'Sustainable Development Goals 2030 - Seychelles Coastal Management' for presentation to the National Assembly." (Gamini Herath Auditor-General Office of the Auditor General Victoria, **Republic of Seychelles**) Some also gained indirect rights from UN resolutions, this was largely due to fact that, resolutions and commitments at the UN level are usually a unanimous decision by member states (SAI government). "The Audit Office of the Institutions of Bosnia and Herzegovina (the Audit Office) conducted a performance audit titled ''Preparedness of the institutions of Bosnia and Herzegovina to respond to commitments made under the 2030 Agenda ". (Audit Office of the Institutions of Bosnia and Herzegovina 2019)

			"Recalling the resolution 66/209 on Promoting the efficiency, accountability, effectiveness and transparency of public administration by strengthening Supreme Audit Institutions and resolution 69/228 on Promoting and fostering the efficiency, accountability, effectiveness and transparency of public administration by strengthening supreme audit institutions, adopted by the United Nations General Assembly, in which the international community………. encourages Member States to give due consideration to the independence and capacity-building of SAIs in a manner consistent with their national institutional structures as well as to the improvement of public accounting systems in accordance with national development plans in the context of the Post-2015 Development Agenda;" (23rd UN/INTOSAI Symposium Report)
Configuring belief systems	Constructing Identities	Defining the relationships between an actor and the field in which that actor operates.	Some audit institutions have created departments or new offices with specific focus on auditing sustainability items, a typical case is that of SAI Canada that it mandated by their audit act. "15.1 (1) The auditor General shall, in accordance with the public service Employment act, appoint a senior officer to be called the Commissioner of the Environment and Sustainability Development who shall report directly to the Auditor general (2) The commissioner shall assist the auditor general in performing the duties of the Auditor General set out in this Act that relate to the environment and sustainable development" (GUID 5202 ,p.55) It also common to find audit teams called, the "SDG audit Team" in a SAI organization.
	Changing Normative Association	Remaking the connections between sets of practices and the moral and cultural foundations of those	"Implementing the Gender Strategy and mainstreaming gender across IDI, its work streams and units, is a continuous joint effort. In 2020, SSU supported and advised IDI and SAI staff in conducting or arranging gender analyses for new initiatives. This included support on how to integrate gender and inclusiveness in the redesigned well-governed and in the relevant SAIs work stream. Gender & inclusiveness considerations feature as cross-cutting issues in all the

		practices	pilots of the IDI SDG Audit Model (ISAM)".(IDI PAR 2020)
	Constructing Normative Networks	Constructing interorganisational connections through which practices become normatively sanctioned and which form the relevant peer group.	"IDI's support also extends regionally. IDI proudly partnered with the Organization of Latin American and Caribbean Supreme Audit Institutions (OLACEFS) to aid member SAIs in auditing national preparedness to implement SDG 5. The publication "Are Nations Prepared for Implementation of the 2030 Agenda?" contains lessons learned from the joint project with OLACEFS, as well as SAIs from other regions." (INTOSAI Journal 2020 spring) "The Canadian Audit and Accountability Foundation, in partnership with the International Institute for Sustainable Development developed guidance on auditing gender equality and the SDGs. This guide helps auditors understand gender equality and its place in the 2030 Agenda. It also helps auditors plan either an audit focused on SDG 5 or an audit that examines gender equality within other SDGs, such as water, agriculture or energy. The guide suggests a list of indicators that gender equality is at risk, questions to understand how prepared the government is, and illustrative examples." "The World Bank Group (WBG) is a natural partner and a strong ally to Supreme Audit Institutions on their work relating to Sustainable Development Goals. The SDGs are aligned with the WBG's twin goals of ending extreme poverty and boosting shared prosperity, and the WBG is working with client countries to deliver on the 2030 Agenda… …… We believe that SAIs can play a key role in contributing towards monitoring the progress of respective countries towards the SDGs. We look forward to collaboration with the INTOSAI WG on SDG KSDI through knowledge exchange, thought leadership and efforts to enhance appreciation of the value of SAI role in the SDGs among all stakeholders including development partners." (Srinivas Gurazada Financial Management Specialist in Governance Sectors of the World Bank- (WG SDG KSDI Journal 1.0-2020))

Altering meaning systems	Mimicry	Associating new practices with existing sets of taken-for-granted practices, technologies and rules in order to ease adoption.	The SDG auditing Practice adopted existing Performance auditing guidance and methodologies, this could be seen in guidance documents and even in SDG audit reports. "Audits of Sustainable development should follow all the usual standards followed by the SAI, for example those established by INTOSAI and any national standards. While sustainable development might be more complex than many other audit topics, for the reasons explained above, this should not mean that standards for planning, gathering evidence, analyzing and reporting can be relaxed" **(GUID 5202, P.15)** " The standards applied to the conduct of audits looking at sustainability development should be no different than any other audits. Audits of sustainable development issues will require the normal four phases of any audit-planning, fieldwork, reporting, and follow-up. The essential objectives -making a difference, promoting accountability and the use of best practices -remain unchanged" (GUID 5202, P.51)
	Theorizing	The development and specification of abstract categories and the elaboration of chains of cause and effect.	"**Audit of SDGs Implementation - Definition** An audit of SDGs implementation is an audit of the implementation of the set of policies that contribute to the achievement of a nationally agreed target linked with one or more SDG targets. It concludes on the progress made towards the achievement of the nationally agreed target; how likely the target is to be achieved based on current trends; and the adequacy of the national target in comparison with the corresponding SDG target(s). An audit of SDGs implementation needs to be conducted using a whole-of-government approach. It needs to conclude on the extent of **coherence and integration** in the implementation of

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			policies and to the extent possible, the audit could include objectives and questions that allow the SAI auditor to conclude on · **leave no one behind; and** · **multi-stakeholder engagement."** ISAM (2020)
	Educating	The educating of actors the skills and knowledge necessary to support the new institution.	"The success of this cooperative audit is a practical demonstration of INTOSAI motto 'Mutual in experience benefits all'. As SAIs move from auditing preparedness to auditing implementation of SDGs, I re-affirm the KSC's commitment to work together with IDI for supporting SAIs in auditing implementation of SDGs." (**Rajiv Mehrishi-** Chair of INTOSAI Committee on Knowledge Sharing and Knowledge Services 2019) "As our contribution to INTOSAI efforts, IDI and KSC have supported 73 SAIs and one subnational audit office across the world, in conducting high quality performance audits of preparedness for implementation of SDGs". (**Per-Kristian Foss,** Auditor General of Norway and Chair of the IDI Board,2019) **"**This week has been very helpful because we will all go back to our countries with a better understanding of everyone's challenges. We can help each other out better, and move forward with implementing the 2030 agenda, which Jordan is ready to do. I would like to thank the Dutch Court of Audit for bringing us together, and everyone else for sharing their experience and knowledge**." (Wasfi Al-Odwan Head of Performance Audit Divisions at the Audit Bureau of Jordan 2018)** "In terms of virtual training activities, the Capacity Building Committee (CCC) of OLACEFS has already had the MOOC on SAIs and the Sustainable Development Goals (SDGs) in Spanish, Portuguese and English since 2018. In November 2020, the CCC again launched the Massive Open Online Course MOOC on Performance Auditing with the support of GIZ. These initiatives

			have had a significant reach among practitioners interested in both themes. Since 2018, 4,249 people have been trained on SDG MOOC in Spanish, 1,181 in Portuguese, and 143 in English." (Minister Augusto Nardes Minister of the Federal Court of Accounts (TCU – Brazil),Chairman of the OLACEFS Capacity Building Committee,2022) "It is in this context of capacity building that we would like to remind everyone about one of the most interesting global public good that the CCC and the OLACEFS offer our region and the entire INTOSAI. This is the massive open online course (MOOC) on the 2030 Agenda and the role of the SAIs in the implementation of the Sustainable Development Goals (SDGs). This initiative, promoted in 2019, with the support of the German Cooperation Agency (GIZ), aims to train professionals to understand the concept and characteristics of the 2030 Agenda, as well as to provide information to assist in conducting audits within the scope of the SDG program."

Appendix D: Sample donor activities with respect to SDG audits

Tittle of Support	Beneficiary level	INTOSAI region(s)	Duration from	Duration to	Total budget (US Dollar):	Source of funding	Support modality	Type of support	Support categories covered
SDG Preparedness Audit for Implementation of SDGs 5 (Gender Equality)	Regional	CREFIAF, EUROSAI	2017-08-31	2019-12-31	$89182	IDI basket funds	In-Kind support	Stand-alone project	Audit of gender issues or Sustainable Development Goal 5 audit
AFROSAI-E and SIDA (Swedish International Development and Coordination Agency) Institutional Partnership(SIDA provides basket funding	Regional	AFROSAI-E				Government of Sweden	Monetary - Grant		Institutional capacity – SAI Independence, Sustainable Development Goals (SDG) audit, Organisational capacity, Financial audit, Compliance Audit, Performance audit, IT Audit,

to support AFROSAI-E's Strategic Plan, 2020-2024.)								Other Specialized Audits, Administrative Services, External Stakeholder Relations
Strategic Development Accelerator Project	Country	AFROSAI	2021-07-01	2025-06-30	$630071	European Commission, Government of Ireland, IDI basket funds, UK Department of International Development	Peer to Peer support	**The Accelerator Project (previously Audit Constellation Project) is a 5-year, multi-component partnership including peer SAIs as well as advisors from some of the world's most prestigious non-governmental organisations.**	Institutional capacity – SAI Independence, Institutional gender capacity, Audit of gender issues or Sustainable Development Goal 5 audit, Organisational capacity, Financial audit, Compliance Audit, IT Audit, External Stakeholder Relations
Good Financial Governance in	Regional	AFROSAI	2018-12-03	2022-01-31	$24401630	German Ministry for	Monetary - Grant	The GIZ programme supports AFROSAI	Institutional gender capacity,

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Africa – AFROSAI						Economic Cooperation and Development (BMZ)		and its language subgroups, technical committees and working groups in the fields of public financial control and the auditing of public institutions. The General Secretariat in Yaoundé is supported in its organisational development and the preparation of environmental audits. Furthermore, AFROSAI is supported in developing a regional methodology of SDG auditing. In order to tackle the underrepresentation	Audit of gender issues or Sustainable Development Goal 5 audit, Sustainable Development Goals (SDG) audit

							of women in SAIs GIZ and AFROSAI developed the Women Leadership Academy	

Appendix E: Extracts From SDG audits reports

Country	Title of report	Year	Report Objectives
Solomon Islands	Solomon Islands Government's preparedness for the Implementation of SDGs into its National System"	2018	These audit objectives are; 1. To what extent has the government adapted the 2030 Agenda into its national context? 2. Has the government identified and secured resources and capacities (means of implementation) needed to implement the 2030 Agenda? 3. Has the government established a mechanism to monitor, follow up, review and report on the progress toward the implementation of the 2030 Agenda?
National Audit Office Sri Lanka	Preparedness for Implementation of Sustainable Development Goals	2018	Audit Objectives There are three main objectives that can be identified in the aspect of Audit Perform as an independent review of this programme.

			i. To what extent had the Government adapted to the 2030 Agenda to its national context? ii. Has the Government identified and secured resources and capacities (means of implementation) needed to implement 2030 Agenda? iii. Has the Government established a mechanism to monitor, follow - up, review and report on the progress towards the implementation of the 2030 Agenda?
NATIONAL AUDIT OFFICE TANZANIA	PERFORMANCE AUDIT ON PREPAREDNESS FOR IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS	2018	The overall objective of the audit was to assess whether MoFP as the leading ministry and the PO-RALG, as the coordinator of LGAs as key implementers are prepared to implement SDGs. Specifically, the Audit aimed to assess whether: x MoFP and PO-RALG adopted SDGs into the national context; x MoFP has identified and secured resources and capacities (means of implementation) needed to implement SDGs; and x MoFP and PO-RALG has established mechanism to monitor, follow up, review and report on the progress towards the implementation of SDGs.
Slovak Republic	Performance Audit of Preparedness for Implementation of Sustainable Development Goals	2018	Audit Objective 1 – To what extent has the government adapted the Agenda 2030 into its national context? Audit Objective 2 – Has the government identified and secured the resources and capacities (means of implementation) needed to implement the Agenda 2030? Audit Objective 3 – Has the government established a mechanism to monitor, followup, review and report on progress towards the implementation of the Agenda 2030?
Audit Service Sierra Leone	Performance Audit Report on the Preparedness for Implementation	2019	The objective of the audit was to assess the 'preparedness for implementation of the 2030 Agenda',

	of the Sustainable Development Goals By the Ministry of Planning and Economic Development		in terms of: 1. The extent to which the Government of Sierra Leone, through the lead implementing agency MoPED has adapted the 2030 Agenda into its national context. 2. The extent to which MoPED has identified and secured resources and capacities needed to implement the 2030 Agenda. 3. The extent to which Statistics Sierra Leone (SSL) and MoPED have established mechanisms to monitor, follow-up, review and report on the progress made towards the implementation of the 2030 Agenda. See Annex 1 for Audit Questions
SAI Sierra Leon	Performance Audit Report on the Preparedness for Implementation of the Sustainable Development Goals By the Ministry of Planning and Economic Development	2019	1. The extent to which the Government of Sierra Leone, through the lead implementing agency MoPED has adapted the 2030 Agenda into its national context. 2. The extent to which MoPED has identified and secured resources and capacities needed to implement the 2030 Agenda. 3. The extent to which Statistics Sierra Leone (SSL) and MoPED have established mechanisms to monitor, follow-up, review and report on the progress made towards the implementation of the 2030 Agenda. See Annex 1 for Audit Questions.
Accounts Chamber of the Russian Federation.	Report on the Results of the Audit "Analysis of the Public Governance System for the Implementation of the Agenda for Sustainable Development in 2019 and the Elapsed Period of	2020	Objective 1. To assess how well the Agenda for Sustainable Development is integrated into the national context11. Objective 2. To analyze the availability of necessary resources for the implementation the Agenda for Sustainable Development. Objective 3. Assess the preparedness of the system for monitoring the implementation of the Agenda for Sustainable Development in the Russian Federation.

	2020"		
SAI Norway	The Office of the Auditor General's investigation of the management and review of the national follow-up of the sustainable development goals	2020	Has the government managed and arranged work on the sustainable development goals in a manner that meets the expectations in the 2030 Agenda? Has the Ministry of Finance arranged for measurement and reporting of the national implementation of the sustainable development goals as required in the 2030 Agenda?
GHANA	To what extent has the government established mechanisms to monitor, follow-up, review and report towards the implementation of Agenda 2030?	2018	To what extent has the Government adopted the 2030 Agenda into the national context? To what extent has the government identified and secured resources and capacities needed for the implementation of the SDGs? To what extent has the government established mechanisms to monitor, follow-up, review and report towards the implementation of Agenda 2030?
India	Report of the Comptroller and Auditor General of India on Audit of Preparedness for the Implementation of Sustainable Development Goals	2019	•to what extent has the Government adapted the 2030 Agenda into its national context; •to what extent has the Government identified and secured resources and capacities needed to implement the 2030 Agenda; •to assess the robustness and accuracy of procedures put in place to track allocation of resources against targets within the SDG; •to what extent has the Government established a mechanism to monitor, follow-up, review and report on the progress towards the implementation of the 2030 Agenda.
MALDIVES	PERFORMANCE AUDIT OF PREPAREDNESS	2019	1. To what extent has the government adapted the 2030 agenda into its national context?

	FOR IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS		2. Has the government identified and secured the resources and capacities (means of implementation) needed to implement the 2030 Agenda? 3. Has the government established a mechanism to monitor, follow-up, review and report on progress towards the implementation of the 2030 Agenda?
MALAYSIA	PREPAREDNESS FOR IMPLEMENTATION OF SUSTAINABLE DEVELOPMENT GOALS IN MALAYSIA	2018	Audit Objective The audit of preparedness for the implementation of the SDGs is divided into 4 objectives as follows: i. To determine the extent of adaption by the Federal Government (Government) on the 2030 Agenda into the national context, institutional framework, integration and inclusiveness. ii. To identify the means of implementation in term of secured resources and capacities needed to implement the 2030 Agenda; iii. To determine whether a mechanism has been established to monitor, follow up, review and report on the progress towards the implementation of the 2030 Agenda. iv. To determine lessons learnt from the implementation of the Millennium Development Goals (MDGs)