Bibliometric Analysis and Review of Digital Audit Practices in the Public Sector of Different Countries

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Abstract

Purpose: The objectives of this paper are two-fold: first, it presents a bibliometric study on digital audit in the public sector of different countries; and Second, it provides review of prior studies on digital audit implementation by governments in various countries.

Design/ Methodology/ Approach: There are two parts in the present study, and both use secondary data. The first part is a bibliometric study of past literature on digital audit in the public sector which was carried out to provide an overview of trend of publications over the last 30 years, citation analysis in terms of top cited journals and articles, as well as author analysis which covers most active single author and author with co-authorship and based on the country of the authors. The second part of the paper uses the content analysis technique on prior literature to extract and compile information on digital audit practices by the public sector of various countries in terms of the year of implementation, current status of implementation, and modules and the software used.

Findings: The results of the first of the study indicate the increasing trend of publications on digital audit in the public sector which are authored by researchers from many countries. This implies the current trend of digital audit movement by governments around the world. For the second part, the review on digital audit practices of governments in different countries reveals several European countries such as Norway, Ukraine and Germany are championing

digital audit in the public sector although none of the countries has full-fledged implementation. Most countries started with taxation audit, and are now having labs or incubators for full-fledged digital audit experimentation in the public sector.

Originality/ Value: The findings of this paper are important due to the followings: (1) it offers insightful evidence into the current development and direction of digital audit research, which ultimately calls for more research efforts on digital audit in the public sector; (2) the information on digital audit practices by several European countries provides essential guidance to the governments of other countries including Malaysia to better prepare for its successful more advanced digital audit implementation journey.

Keywords: Digital audit, public sector, bibliometric analysis, digital transformation.

1.0 Introduction

As technology evolves and businesses become highly dependent on digital systems and processes, the need for accurate and thorough digital audits has become crucial in the private and public sectors. Generally, digital auditing is an activity of utilising digital technology, tools, and technologies to deliver audit work (Audit Scotland, 2017). According to Noël (2020), digital audit concerns utilising advanced techniques, such as data mining and software robots, to perform an audit. Globally, the practice of digital audit has spread rapidly, with several European Union (EU) countries among the earliest adopters. Singapore was the first country in Southeast Asia to adopt it (Podik, 2019).

Several fundamental reasons exist for governments to shift from the traditional type of audit to digital audit. Among other reasons, the use of advanced technology allows the auditing processes to run automatically, thus removing any standardised or repetitive parts in manual auditing, which has led to auditors' greater efficiency and productivity (Tiberius & Hirth, 2019; Kelly, 2020), and reduced risk of human error (Moffitt et al., 2018). Moreover, the application of big data and data analytics in public sector auditing can improve the quality of audit engagement in terms of having clearer and more understandable insights into public sector entities, which ultimately can enhance government accountability and transparency (Kelly, 2020; Lazarevska et al., 2022).

Despite the overwhelming benefits of digital audit, its implementation is not without challenges. Unlike developed countries, governments of numerous developing countries face challenges in shifting towards technology-based auditing due to low awareness and acceptance among the auditors to embark on digital audits (Lazarevska et al., 2022). Moreover, data unavailability due to the decentralisation of government activities at various levels is also a fundamental challenge towards fully implementing digital audits (Otia, 2022). Insufficient funding to invest in digital technology infrastructure, the low quality of available digital technology infrastructure, and high bureaucracy practices are also among the challenges faced in adopting digital audit, particularly among numerous smaller developing countries (Lois et al., 2020).

Although digital audit implementation poses obstacles, under the digital transformation initiative in line with the Sustainable Development Agenda 2030, the rapid development of digital audit implementation in developed and developing countries is evident (Volkova et al., 2021). According to Kostiantyn and Yulia (2021), the Organisation for Economic Cooperation and Development (OECD) first introduced the concept of e-audit in Europe through the Standard Audit File for Tax (SAF-T) in 2005. The system has assisted public and private auditors in performing tax audits for the last ten years. Portugal, Austria, Luxembourg, Germany, Norway, France, and Singapore have implemented e-audit, particularly for tax audit practices. Countries, including Lithuania and Ukraine, have also embarked on and are still in the process of improving digital audit practices implementation.

The rapid shift towards digital audit by governments in many countries and the increasing trend of research on digital audit practices in the public sector have motivated the researcher to undertake a bibliometric analysis to understand the various research foci of the extant literature on digital audit in the public sector. In addition, the present study provides information on the current status of digital audit practices in several countries based on a review of prior literature. The study's findings are vital as they offer insightful evidence into the current development and direction of digital audit research, which ultimately necessitates additional research efforts on digital audit in the public sector. Essentially, the information on digital audit practices by several countries, such as information related to the software used and the establishment of an 'incubator' for initial full-fledged implementation, provides essential guidance to the governments of other countries, including Malaysia, to better prepare for a successful and an advanced digital audit implementation journey.

The remainder of this paper is structured as follows: Section 2 discusses the development of digital audit in the public sector, which covers global digital transformation and digital audit development, as well as the Malaysian government's digital transformation initiatives. Section 3 describes the methodology and procedures utilised in undertaking the bibliometric analysis and the thorough review of past studies. Subsequently, Section 4 presents the bibliometric analysis findings regarding the trend of publications on digital auditing in the public sector, top impactful publications and publication avenues, active authors, and collaboration between authors on public sector digital auditing studies. Section 5 provides information on other countries' experience in implementing digital audits regarding the year of implementation, the current status of implementation and modules, and the software used. The final section, Section 6, offers the study's implications, limitations, suggestions for future research, and finally, a concluding remark.

2.0 Digitalisation Agenda in the Public Sector

Digital technologies are the key enablers of socioeconomic development (Korol et al., 2022). Technological revolutions have changed the way humans live and work by creating new opportunities and empowering people with access to information, goods, and services that were previously unavailable. The Internet, cloud computing, and the advancement of emerging technologies, such as big data analytics, artificial intelligence (AI), robotic process automation (RPA), and blockchain, can speed up digitisation by converting analogue data to a digital format. In turn, data digitalisation makes data highly accessible, transparent, and shareable, which can facilitate faster and better decision-making.

Similar to other economic sectors, leveraging technology by the public sector is a game changer for governments. Modernising government services, operations, and processes have the potential to make governments efficient, effective, and transparent to meet citizens' needs better (Korol et al., 2022). For instance, the shift from traditional paper-based processes to electronic and digital processes has improved efficiency, accuracy, and cost savings and increased access to services for citizens (Azzone, 2018; Antipova, 2019).

South Korea is at the forefront of harnessing the benefits of digital technologies in terms of providing state online services and e-government development. The country initiated its online portal, "e-Government", as early as the 1980s to provide citizens with easy access to government services. Similarly, the EU has implemented various measures to improve the data utilisation and sharing by public agencies, such as the establishment of the European Court Auditors (ECA) and the introduction of the European Data Protection Regulation (2018) to support the full digitalisation of the European Commission by 2024 (ECA, 2020).

2.1 Digital Transformation of the Malaysian Government

Malaysia began to embark on its digitalisation journey in 1996 by establishing the Multimedia Super Corridor (MSC) envisioned by the former Prime Minister, Tun Dr. Mahathir Mohamed. The government has introduced various policies to promote technological and digital transformation, as shown in Figure 1.
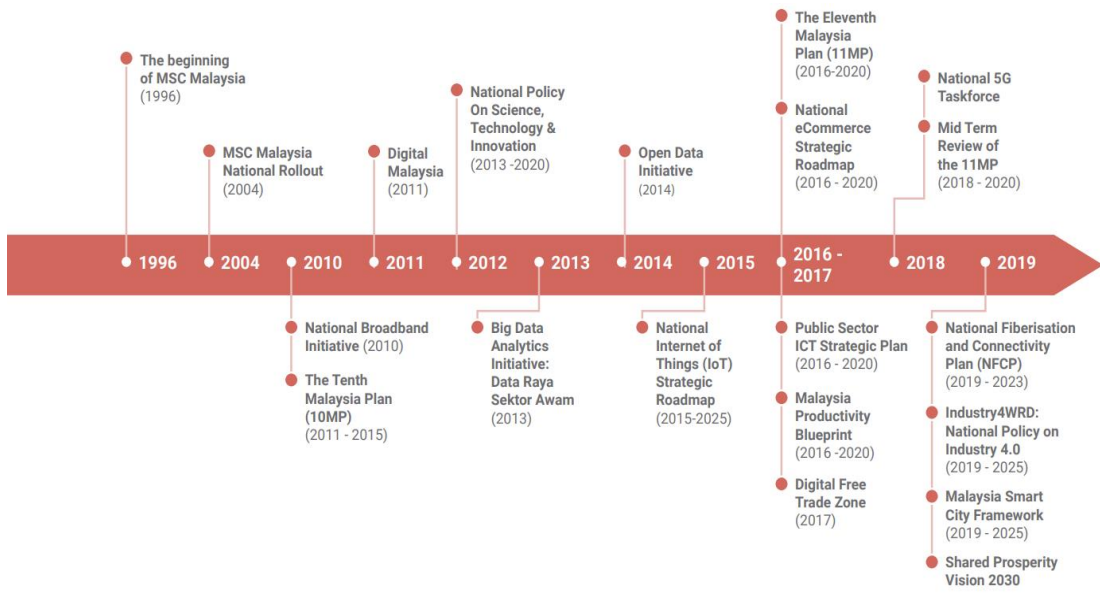

Figure 1: The Development of Digital Initiatives of the Malaysian Government
Source: Malaysia Digital Economy Blueprint (2021)

In response to the Fourth Industrial Revolution (4IR) and the rapid advancement of disruptive technologies, the government introduced a ten-year digital economy blueprint (2021-2030) known as MyDIGITAL in 2020 to set the direction and strategise initiatives towards becoming

a digitally-driven, high-income nation, and a regional leader in digital economy implementation. MyDIGITAL catalyses the realisation of the Twelfth Malaysia Plan and Shared Prosperity Vision 2030 (SPV 2030), where the digital economy is identified as a key economic growth area (KEGA) to achieve inclusive, responsible, and sustainable socioeconomic development.

In a fast-changing digital world and rapid globalisation, MyDIGITAL provides the way forward to realise the potential of a digital economy fully. As shown in Figure 2, one of the key thrusts of MyDIGITAL, for instance, Thrust 1, is to drive digital transformation in the public sector, emphasising the use of digital technology to enhance workflow efficiency and productivity, improve the digital skill sets of civil servants, and utilise data to enhance government services. Audit is one of the important government activities subject to digital transformation.
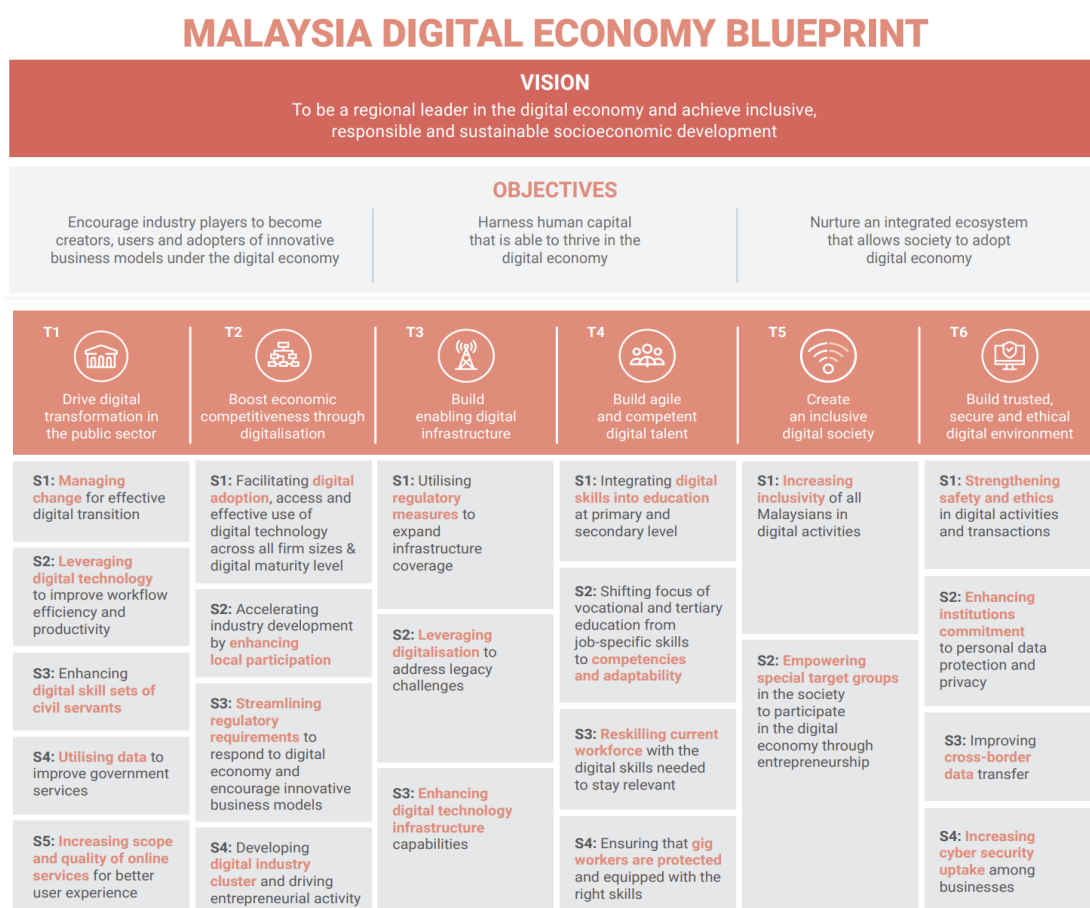

Figure 2: Malaysia Digital Economy Blueprint - MyDIGITAL

3.0 Research Methodology

The present study encompasses two parts, which utilise secondary data. The first part is a bibliometric analysis of past literature concerning digital audits in the public sector, which was undertaken to provide an overview of trends, discover research gaps, and generate new ideas

for subsequent studies, besides contributing to the extant literature (Donthu et al., 2021). In undertaking the bibliometric analysis, procedures described in the subsequent sub-sections were followed. The second part of the study employed content analysis techniques to extract and compile information on digital audit practices in the public sector of various countries. This analysis was conducted on prior literature and official documents, focusing on aspects such as the year of implementation, current implementation status, and the modules and software used.

3.1 Bibliometric Analysis Procedures

Figure 3 displays how the research protocol developed by Lardo et al. (2022) was adapted in this study to eliminate the possibility of making mistakes during article selection or overlooking the necessary procedures. The protocol contains three phases: Phase 1 (Dataset setting), Phase 2 (Data refining), and Phase 3 (Data analysis).
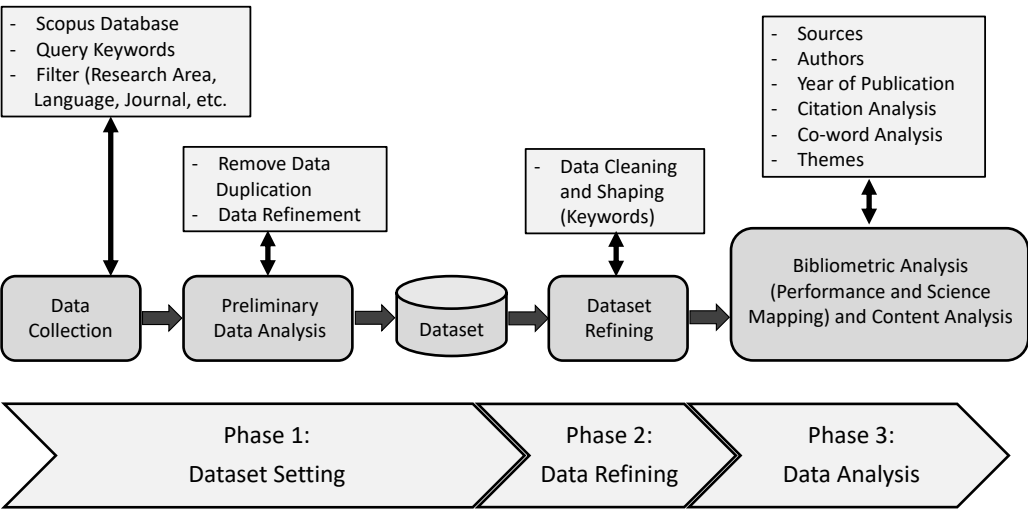

Figure 3: Research Protocol
Source: Lardo et al. (2022)

Phase 1: Dataset Setting

The Scopus database (comprising journal papers) was employed to collect data for the study due to its breadth of coverage, accuracy, and vast data availability. It is trusted and utilised by leading academic, business, and government institutions. The database includes over 87 million documents, 1.8 billion cited references, 17 million authors, 7,000 publishers, and 94,000 institutions (Elsevier, 2023). Relevant journal papers from the Scopus database were gathered in March 2023. The study used keywords such as "digital" and "audit" and "government" or "public sector" to find the pertinent body of literature. "TITLE-ABS-KEY (digital* AND audit* AND government OR {public sector})" was the search query constructed and applied in the database. The collection of datasets is essential to understand the research coverage. As a result, a total of 251 relevant documents were identified.

Phase 2: Dataset Refining

Dataset refining involves cleaning and shaping the data. The cleaning focuses on fixing and removing incorrect, incomplete, improperly formatted, or duplicated data. In contrast, shaping the data is undertaken by filtering, sorting, combining, and removing columns (IBM, 2021). The dataset utilised for a bibliometric analysis requires cleaning to remove any duplication and erroneous entries (Donthu et al., 2021). The keywords with similar meanings, such as "audit" and/ or "audits", must be cleaned. The data refining process involving the selection of the relevant journal papers was conducted manually and independently by three researchers to ensure that no relevant journal papers were omitted. After the refinement phase, the final dataset used in this study consisted of 47 journal papers.

Phase 3: Data Analysis

The data analysis method developed by Donthu et al. (2021) was utilised in analysing the 47 datasets. The method contains two parts: science mapping and performance analysis and enrichment technique. In the present study, science mapping and performance analysis covers the analysis of keywords, authorships, and publication trends by year and number. The second part of the analysis encompasses an enrichment utilising a network analysis that employs VOSviewer visualisation tools. The VOSviewer is software for visualising bibliometric networks, creating network maps, and researching them (Van Eck & Waltman, 2023). These networks may include journals, researchers, or individual publications and can be constructed based on citation, co-occurrence, co-citation, or co-authorship relations. In this study, citation and co-authorship analyses using VOSviewer were used, and the results are presented in Section 4.

4.0 Findings on Bibliometric Analysis

The findings from the bibliometric analysis undertaken in the present paper include publication trend on digital audit in the public sector over the last 30 years, citation analysis in terms of the top cited journals and articles, and author analysis, which comprises the most active single author and author with co-authorship and based on the authors' country. The results are presented in the following sub-sections.

4.1 Trend of Publication Over 30 Years

As shown in Figure 4, the publication on digital audit in the public sector started in 1993. Nevertheless, there were no publications on this topic until 2001, when only one (2%) publication emerged. Similarly, there was a gap of almost ten years until 2010, with only one (2%) publication on digital audit in the public sector. Between 2015 and 2022, except for 2021, there was an increasing trend in the number of publications on digital audit in the public sector, with the highest number of publications of 14 papers (30%) in 2022. The rising trend of published works in recent years implies that the current shift towards digital audit in the public sector aligns with the digital transformation agenda of various governments globally.
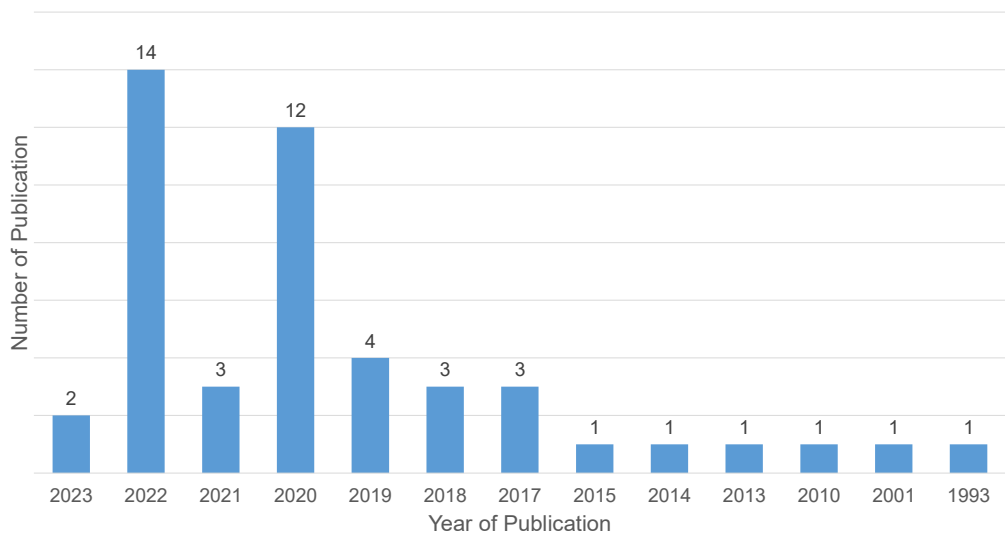
Figure 4: Performance Analysis by Year of Publication

4.2 Citation Analysis

Citation analysis assists in detecting popular research topics and papers that other researchers published (Van Eck & Waltman, 2023). The citation analyses covered in the present study include the most cited journals and documents or papers. The subsequent sub-sections present the results of each of the analyses.

4.2.1 Top Cited Journals

According to VOSviewer findings, among 40 different sources or journals with publications on digital audit in the public sector, Government Information Quarterly is the most cited journal, with 59 citations and two relevant papers on this topic. The titles of the two papers are: 'Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)' and 'Transparency and Accountability in Digital Public Services: Learning from the Brazilian Cases'. Subsequently, the Iberian Conference on Information Systems and Technologies (CISTI) is the next most cited journal with 22 citations and three publications, followed by the Financial Accountability and Management journal with 14 citations and five publications.

4.2.2 Top Cited Articles

In terms of article citation, all 47 documents or journal articles were cited at least five times. The journal article by Brown et al. (2017) entitled, 'Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)' published in the Government Information Quarterly, had the highest number of citations (56 citations). The authors proposed a platform model known as Platform Appraisal Framework (PAF), which adopts a more advanced

technology than the existing government digital platform (for instance, GaaP) to support the digital audit initiative of the United Kingdom (UK) government.

The second most cited article is the article by Shah and Khan (2020) entitled 'Secondary Use of Electronic Health Record: Opportunities and Challenges' with 17 citations and published in IEEE Access. The authors demonstrated how Electronic Health Records (EHR) data could be utilised for numerous purposes, including clinical audit. Moreover, the article emphasises data security and patients' privacy risks associated with secondary EHR usage, particularly when EHR data are sent across a network and shared with many stakeholders. Antipova's (2018) article, 'Using Blockchain Technology for Government Auditing', is the third most cited article. The article was published in the CISTI and has 15 citations to date. The author discussed the application of blockchain and digital technologies in government auditing to enhance data security and prevent fraud in government funds, outlining the related issues and techniques.

The article by Loukis and Spinellis (2001) titled, 'Information Systems Security in the Greek Public Sector', published in the Information Management and Computer Security, has ten citations and is ranked as the fourth most cited. The authors studied several aspects of public sector information systems security, encompassing awareness, the measures (backup copies, restoring data and firewall), and digital data confidentiality. The article titled 'Digital Public Sector Auditing: A Look into Future', published in the Quality - Access to Success, with eight citations and authored by Antipova (2019), is ranked number five. The article explores the potential of digitalisation in public sector auditing, enabling auditors to detect fraud and inefficiency more effectively through advanced technologies, ultimately enhancing accountability and transparency. The author proposed four main blocks of future public sector auditing: Digitalisation, Preliminary, Continuity, and Analysis.

Two articles, each with six citations, were authored by Bansod and Ragha (2020) and Mosweu and Ngoepe (2019). Bansod and Ragha's article, titled 'Blockchain Technology: Applications and Research Challenges,' was published at the 2020 International Conference for Emerging Technology (INCET 2020). The article by Mosweu and Ngoepe (2019), titled 'Skills and Competencies for Authenticating Digital Records to Support Audit Process in Botswana Public Sector,' was published in the African Journal of Library Archives and Information Science. Bansod and Ragha (2020) discussed several challenges, such as privacy, scalability, integration, standards, software testing, security, and smart contract management, which blockchain technology faces. As technology evolves, the number of attackers or hackers who attempt to break into the system also increases. On the other hand, Mosweu and Ngoepe (2019) studied the skills and competencies to verify digital accounting records in the Government Accounting and Budgeting System (GABS). They discovered that professionals and auditors in the public sector in Botswana lack digital forensic knowledge.

4.3 Authorship and Co-Authorship Analysis

An authorship analysis was undertaken to highlight active researchers. In contrast, co-authorship analysis was undertaken to determine the total number of publications with which two or more researchers have worked together (Van Eck & Waltman, 2023).

4.3.1 Most Active Authors

A total of 112 authors or researchers have written and published paper(s) on digital audit in the public sector over the past 30 years. Table 1 provides information regarding the top most active authors who have published between two and four papers on digital audit in the public sector. Tatiana Antipova from Russia is the most active author with four single authorship publications. As mentioned in the earlier section, one of her publications from 2018 is among the most cited papers. Her active involvement in publishing articles on digital audits in the public sector is due to her direct involvement in the planning for implementing digital audits in the Russian government. Ileana Steccolini from the University of Essex, UK, and Enrico Bracci from the University of Ferrara, Italy, have both published three articles on the issues of government implementation of digital audit.

4.3.2 Most Active Authors with Co-authorship

In co-authorship analysis, the total link strength (TLS) signifies the number of authors who have collaborated as co-authors (Van Eck & Waltman, 2023). Among the 112 authors in the field of digital audit in the public sector, only eight have engaged in co-authorship. The TLS ranges from one to seven, as indicated in Table 1. Ileana Steccolini has the highest TLS with seven publications, followed by Enrico Bracci with six TLS. Ileana Steccolini co-authored three articles with researchers from various universities in the UK, Australia, Canada, and Italy. Her first article, 'The Future of Public Audit,' is co-authored with Laurance Ferry and Vaughan S. Radcliffe from Durham University, UK, and the Ivey Business School, Canada, respectively. The second article, 'Performance auditing in the public sector: A systematic literature review and future research avenues', was co-authored with three other researchers, Tarek Rana, Dessalegn Getie Mihret, and Enrico Bracci. The first two co-authors are from RMIT, Australia, while the third co-author hailed from the University of Ferrara, Italy. The third article, 'Accounting and accountability for the digital transformation of public services', was published by collaborating with Deborah Agostino and Enrico Bracci.

Table 1: Top Eight Authors Based on Co-Authorship Analysis

Rank	Author's Name	Affiliation	Country	No. of Articles	Citations	Total Link Strength
1	Ileana Steccolini	University of Essex	United Kingdom	3	9	7
2	Enrico Bracci	University of Ferrara	Italy	3	10	6
3	Javis Ebua Otia	University of Ferrara	Italy	1	4	1
4	Dessalegn Getie Mihret	RMIT University	Australia	1	4	3
5	Tarek Rana	RMIT University	Australia	1	4	3
6	Laurance Ferry	Durham University Business School	United Kingdom	1	3	2
7	Vaughan S. Radcliffe	Ivey Business School	Canada	1	3	2
8	Deborah Agostino	Politecnico di Milano	Italy	1	2	2

4.3.3 Frequency of Authors Based on Country

The information on the number of authors based on the country was gathered to explore the diversity of the researchers and authors in public sector digital audit. Table 2 displays 110 authors from 27 countries who have contributed to research publications on digital audit in the public sector. China and Brazil have more than ten authors, with 21 and 11 authors, respectively. India, the UK, the United States, Australia, Greece, Italy, and the Netherlands have at least five authors on digital audit in the public sector.

Table 2: Frequency of Authors Based on Country

No.	Country	Number of Author(s)	No.	Country	Number of Author(s)
1.	Australia	5	15.	Pakistan	2
2.	Bangladesh	4	16.	Portugal	3
3.	Brazil	11	17.	Russia	1
4.	Bulgaria	1	18.	Saudi Arabia	1
5.	Canada	1	19.	Singapore	2
6.	China	21	20.	South Africa	2
7.	Ecuador	1	21.	South Korea	1
8.	Greece	5	22.	Spain	1
9.	India	8	23.	Turkey	4
10.	Italy	5	24.	United Kingdom	8
11.	Kazakhstan	4	25.	United States	7
12.	Mauritius	1	26.	Ukraine	2
13.	Namibia	2	27.	Vietnam	2
14.	Netherlands	5		**Total**	**110**

The results of the co-authorship analysis revealed that authors from seven countries have collaborated with authors from other countries. Figure 5 illustrates the connection between the seven countries, namely the UK, Italy, Brazil, Greece, Australia, the United States, and Turkey. UK has the highest connection with six TLS, which implies that the authors from the country collaborated and co-authored their work with authors from many other countries.
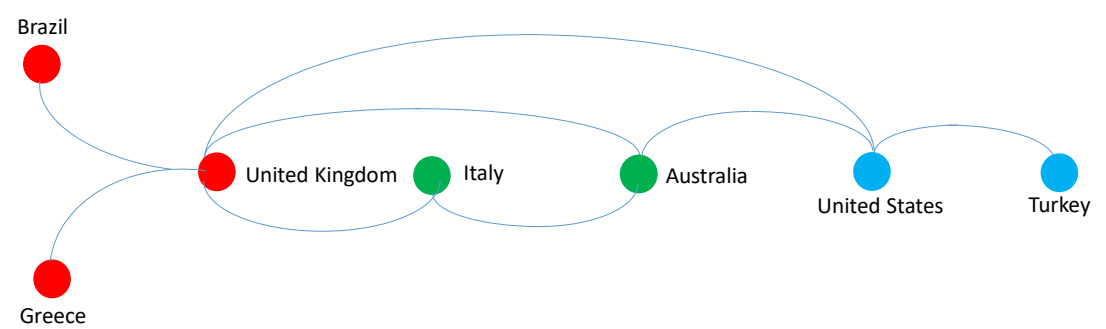

Figure 5: Co-Authorship Analysis by Countries

In addition, the analysis revealed three clusters of collaboration between countries, as shown in Figure 5. The first cluster comprises the UK, Brazil, and Greece. The second cluster encompasses Italy and Australia, while the third cluster comprises Turkey and the United States. The clusters represent the collaboration groups among authors by country.

5.0 Digital Audit Practices in Other Countries

This second part of the findings presents information on the development, status, and initiatives of various countries in relation to their digital audit practices. Although numerous prior studies or publications have been undertaken on digital audit in the public sector, as covered in Section 4, only several publications contain information on digital audit practices in a specific country. Hence, the remainder of this section discusses digital audit practices in specific countries as covered by prior studies. The discussion will first cover the digital audit practices in European countries, followed by Asian countries. Specifically, the discussion will explore how different countries have embraced digitalisation and the specific systems or tools they utilise.

5.1 Digital Audit Practices in European Countries

In line with the EU's full digitalisation of public administration and financial management agenda, the ECA, as the external auditors of EU finances, has established ECALab, intending to transform and enhance audit function using technological advancements (Otia & Bracci, 2022). ECALab is an incubator specially designed to explore and test new digital audit solutions and technologies in a controlled environment before its full-fledged implementation in the public sector (Otia & Bracci, 2022). ECALab plays a crucial role in keeping auditors updated on current technological trends and helping them effectively utilise technology to enhance the audit process (ECA, 2020). As shown in Figure 6, the cycle begins with a continuous technological watch, conducting in-house experiments, learning from other EU institutions, and, lastly, transferring the knowledge to auditors.
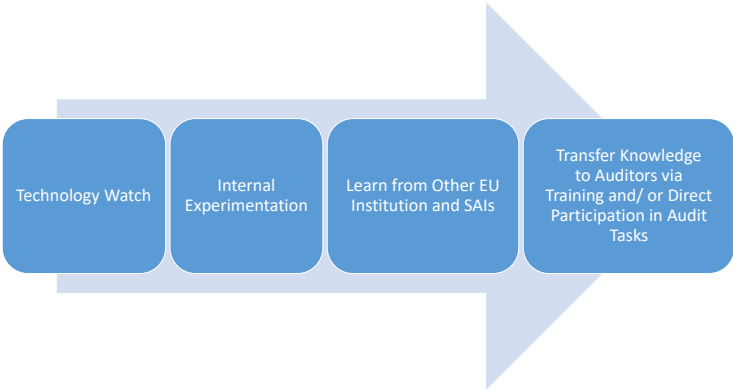
| Technology Watch | Internal Experimentation | Learn from Other EU Institution and SAIs | Transfer Knowledge to Auditors via Training and/ or Direct Participation in Audit Tasks |

Figure 6: ECALab Helps Auditors to Stay Up-To-Date with Innovation

In addition to ECALab, several other incubators have been developed by European countries and North America for the same purpose. Table 3 provides information on the incubators and their origin, as reported by Otia and Bracci (2022).

Table 3: Digital Audit Incubators in Different Countries

Country (Supreme Audit Institution)	Name of Innovation/ Incubator
European Union (European Court of Auditors)	ECALab
Norway (Office of the Auditor General)	Innovation Lab
The Netherlands (Court of Audit)	Innovation Lab
Belgium	DataLab
The United States (Government Accountability Office)	Innovation Lab
Brazil (Federal Court of Accounts)	coLAB-I

5.1.1 Norway

The Office of the Auditor General of Norway established the Innovation Lab in 2019 to assist them in addressing the impact of technology on the audit community (ECA, 2020). Prior to its establishment, Norway had already introduced the SAF-T in 2014 (Podik et al., 2019). The SAF-T is a standardised reporting format that taxpayers utilise to electronically provide tax authorities with accounting and financial information concerning the status and availability of assets, liabilities, equity, and changes in the taxpayer's financial and economic condition over a specific period (Podik, 2019; Bezverkhyi, 2021; Bezverkhyi & Poddubna, 2023). Norway has made multiple upgrades to the system throughout the implementation phases. One of the new features introduced is the SAF-T Cash Register, designed to export data from cash registers. This file can be generated upon request by the Norwegian tax administration, accountants, or other participants. It also serves as a means to transfer cash register data to accounting systems (Podik et al., 2019).

5.1.2 Ukraine

In 2020, Ukraine took a significant step towards digital audit implementation by introducing its own version of SAF-T. This initiative aligns with the country's agenda to reform the State Finance Management System, highlighting the significance of digital audit as part of broader financial management reforms (Bezverkhyi & Poddubna, 2023).

5.1.3 Russia

In 2015, the Audit Chamber of the Russian Federation initiated an experiment to explore the advantages of digital technologies in auditing (Otia & Bracci, 2022). As part of this initiative, remote audit was introduced by utilising an information analysis system (IAS). The outcomes of this endeavour were remarkable, as the auditors identified 650 procedural violations among state agencies (Otia & Bracci, 2022).

5.1.4 Italy

After the mandatory adoption of Extensible Business Reporting Language (XBRL) for financial reporting by public entities, the Court of Auditors introduced the Local Government Harmonised Monitoring Control System (SMART). The SMART initiative enables the government to collect financial statements from local governments using XBRL (Soverchia & Fradeani, 2018).

5.1.5 Germany

Germany is the first country to develop its own audit file format known as "EBilanz". The pilot project for EBilanz was introduced in 2011. All taxpayers were required to use the system to generate financial statements in electronic form by 2013 (Kostiantyn & Yulia, 2021).

5.1.6 Poland

Similarly, Poland introduced its own standard tax audit file in 2016 by requiring all large taxpayers to submit a single control file to the authorities. In 2017, the system was made mandatory for small and medium enterprises (Podik et al., 2019).

In summary, the digital audit practices in the public sector of European countries are still in the developmental phase and not yet fully matured. These practices are rather relatively concentrated on the taxation audit. Auditing taxpayers' tax files submitted in the XBRL platform (online submission) is the primary reason governments implement e-audit (Bezverkhyi & Poddubna, 2023). Table 4 details the specific names of e-audit modules used in various European countries, their year of implementation, structure, and the associated software from the recent publication of Bezverkhyi and Poddubna (2023).

Table 4: e-Audit Implementation in the European Countries

Country	Name	Year of Implementation	Structure (Sections)	Software
Portugal	SAF-T (PT)	• 2008 - On a voluntary basis only for large taxpayers • 2010 - As a mandatory measure for all economic entities that keep records in the electronic system	Four ("Header", "Main files", "Journal of accounting entries" and "Primary documents")	IDEA
Austria	SAF-T (AT)	• April 2009	Six ("Header", "Main files", "Journal of accounting entries", "Inventory Balances", "Primary Documents", and "Asset Information")	ACL
Germany	E-Bilanz	• 2011 - Pilot project: E-Bilanz • 2013 - Mandatory for all tax-payers who prepare financial statements in electronic form	E-Bilanz for Germany - Versions Taxonomy and E-Bilanz Sheet	IDEA
Luxembourg	FAIA (FAIA 2.01 full, FAIA 2.01 v. A and FAIA 2.01 v. B)	• 2008 - Adoption of the regulatory act on cooperation between tax authorities • November 2009 - First edition (November 2010 - Implementation) • 2013 - Published FAIA v. 2.01	Four - Based on OECD SAF-T version 2.0 (FAIA 2.01 full); v. A - Less subdivisions v. B - Only three sections (no "Primary Documents"), fewer subsections	Programme based on SAP ERP
Norway	SAF-T Financial 1.2	• 2014 - SAF-T Financial 1.0 • June 2017 - SAF-T Financial 1.2	Three ("Header", "Main files", "Journal of accounting entries")	ACL, SESAM

Country	Name	Year of Implementation	Structure (Sections)	Software
France	SAF-T FEC	• January 1, 2014 - A unified file format and structure was put into effect	Four different XML schemas	ACL
Sweden	Standard Import Export (SIE) XML	• 2014	Four types: Balance, additional balance, profit, operations, transactions	ACL, SESAM
Lithuania	SAF-T	• 2015	Complies with the SAF-T version 2.0 framework	SESAM (IC ESKORT)
Poland	JPK	• 2016 - Only large taxpayers had to submit JPK to the fiscal authorities • January 2017 - The obligation was imposed on small and medum-sized enterprises	Seven parts (JPK VAT ("Title", "Entities", "Sales", "Tax liabilities", "Purchases", "Tax credit") - Mandatory; JPK KR, JPK WB, JPK MAG, JPK FA, JPK PKPIR and JPK EWP - (Submitted within three days at the request of the supervisory authority)	ACL

Source: Bezverkhyi and Poddubna (2023)

5.2 Digital Audit Practices in Asian Countries

While certain Asian countries, such as Singapore and China, have been proactive in leveraging technologies to enhance the audit function in the public sector, the overall adoption of digital audit practices in the region is lower compared to European countries.

5.2.1 Singapore

Singapore is the only Asian country that has implemented SAF-T. The first version of the system, "IRAS Audit File (IAF) v 1", was published in 2005 (Podik et al., 2019). Since then, Singapore has developed and released four versions of IAF to enhance its tax audit processes.

5.2.2 China

The Department of Electronic Data Audit was created in 2014 to collect, verify, and process electronic data related to audits (Otia & Bracci, 2022). Subsequently, the Golden Audit Project was initiated in 2015 by focusing on big data. China is currently taking the initiative to promote the digitised audit approach and explore more comprehensive analysis (Otia & Bracci, 2022).

6.0 Implications, Limitations, Suggestions for Future Research and Conclusion

The present paper has two objectives. First, a bibliometric analysis of digital audits in the public sector was undertaken. Second, literature on digital audit practices by the governments of various countries was reviewed. The present study reveals a growing trend in publications on digital audit in the public sector authored by researchers from various countries, indicating a

global movement towards digital audit by governments. The finding indicates good prospects for additional research, which may inspire researchers, academicians, and experts from multiple disciplines, including information technology, auditing, and public sector accounting, to undertake comprehensive studies on various aspects of digital audit implementation in the public sector. As none of the countries globally has fully digitalised all its audit work processes, empirical research on critical factors for successful digital audit implementation is crucial to be undertaken. Local researchers interested in learning about digital audit practices in different countries may benefit from collaborating with international experts. Such collaboration can expedite the implementation of digital audit practices in their own country.

The review of digital audit practices of the governments in other countries reveals that a number of European countries, namely Norway, Ukraine, Russia, and Germany, are more advanced in their digital audit practices compared to Asian countries such as China and Singapore. Many of those countries started with digital taxation audits and currently have labs or incubators to experiment with full-fledged digital audit implementation in their respective governments. Overall, the review of literature on other countries' digital audit practices concludes that the adoption of digital audit in the public sector is still in its early stages mainly due to the complex regulatory environment, cultural resistance, and the lack of resources and expertise (Otia & Bracci, 2022). As government data contains sensitive and confidential information, data security and the risk of data loss are concerns, as many government agencies are not fully prepared for disaster recovery plans (Al-Ruithe et al., 2018). Given the challenges, a strategic approach is necessary to ensure successful digital audit implementation. The approach goes beyond adopting various technologies and simply expecting these technologies to help make changes.

As various parties are involved in implementing digital audits by the public sector, each party has a unique role to contribute to ensure a smooth and successful implementation in the near future. At the strategic level, the relevant government authorities or top government management have crucial roles in propagating and publicising the agenda of digital audit transformation in the public sector, which can be achieved through a consistent emphasis on government strategic planning, such as the five-year Malaysia Plan and in public discourses. Furthermore, top management support in terms of sufficient allocation of monetary resources to procure the latest and reliable technology is equally crucial. At the operational level, the relevant government agencies must develop specific information technology (IT) expertise among the staff, such as the knowledge and skills in using audit software and other technological tools. Therefore, organising workshops or sending staff for IT training related to audit is important. Furthermore, establishing an IT or data analytics unit within government agencies involved in audit work may be useful to have close support on digital audit technical matters.

Several limitations exist in the present study. First, the study only considered articles from the Scopus database. Prior studies on digital audit in the public sector from other databases were not included. In order to ensure comprehensive coverage of past literature on digital audit in the public sector, future studies should cover more databases, such as the Web of Science, in searching for the relevant literature and further embark on thematic analysis. Secondly, this study relied on secondary data, employing bibliometric analysis and a literature review to investigate the current status of digital audit practices in other countries. Although the present study's findings are useful, future studies should consider adopting other

methodological approaches, including case studies and interviews with experts from various countries, to obtain richer information on digital audit practices in other countries.

Furthermore, as digital auditing is less common in the public sector, particularly in developing countries, further research is required to assess its current implementation. Future research, particularly in resource-constrained environments, may assess the readiness of developing countries for digital auditing, including financial and human resource considerations. Moreover, future research may also consider conducting a comparative analysis of digital auditing frameworks (technologies, regulations, human resources, and financial resources) implemented in developed countries and their applicability in developing countries. Examining data security and privacy concerns in data sharing, which forms the core of digital auditing, would also be a valuable avenue for future research. Despite the study's limitations, the findings offer valuable information on the current status of digital audit implementation in various countries, which could be vital to other countries planning to embark on digital audit transformation.

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