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Examining the Influence of Expert Systems and Decision Support Systems on Auditing

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Abstract

The face of auditing as a practice has evolved over the last decade, with technological advancement playing a vital role in this transformation. Artificial intelligence is one technological development that has influenced the auditing practice recently, with Decision Support Systems and Expert Systems being some of the main forms infiltrating the audit practice. These systems are expected to revolutionise 'auditors' performance of their core functions, consequently enhancing 'auditors' capabilities and boosting audit reports' independence, trustworthiness, and transparency. With a systematic literature review approach, this article reviewed empirical literature on how Decision Support Systems and Expert Systems have influenced global auditing. It was revealed that the deployment of Expert Systems in auditing improved the assessment of risks associated with financial reporting. Again, Expert Systems were useful in fraud detection, with the technology having the capability to identify fraudulent activities. Decision Support Systems were also seen in data management, improving the application of financial ratios in decision-making and monitoring ongoing auditing processes. The application of these systems was revealed to be crucial in identifying and eliminating inefficiency in businesses, thereby boosting productivity. This article, therefore, concludes that auditing practices across the world stand to benefit immensely if Decision Support Systems and Expert Systems are appropriately implemented. For this to be realised, auditors may need training on the various functionalities of the systems. Since the systems thrive on the value and nature of data fed into them, auditors may have to be meticulous with the nature of data provided in the system.

Keywords: *Auditing, Decision Support Systems, Expert Systems,*

Abstrak

Amalan pengauditan telah berkembang sejak sedekad yang lalu, terutamanya dengan kemajuan teknologi yang telah memainkan peranan penting dalam transformasi ini. Kecerdasan buatan ialah satu perkembangan teknologi yang telah mempengaruhi amalan pengauditan baru-baru ini, dengan Sistem Sokongan Keputusan dan Sistem Pakar menjadi beberapa bentuk utama yang menyusup ke dalam amalan audit. Sistem ini dijangka merevolusikan prestasi 'juruaudit' bagi fungsi teras mereka, seterusnya meningkatkan keupayaan 'juruaudit' dan meningkatkan kebebasan, kebolehpercayaan dan ketelusan laporan audit. Menerusi pendekatan kajian literatur yang sistematik, artikel ini menyemak literatur empirikal tentang cara Sistem Sokongan Keputusan dan Sistem Pakar dalam mempengaruhi pengauditan global. Didapati bahawa penggunaan Sistem Pakar dalam pengauditan meningkatkan penilaian risiko yang berkaitan dengan pelaporan kewangan. Tambahan lagi, Sistem Pakar berguna dalam pengesanan penipuan, dengan teknologi yang

mempunyai keupayaan untuk mengenal pasti aktiviti penipuan. Sistem Sokongan Keputusan juga dilihat dalam pengurusan data, menambah baik penggunaan nisbah kewangan dalam membuat keputusan dan memantau proses pengauditan yang berterusan. Aplikasi sistem ini didapati amat penting dalam mengenal pasti dan menghapuskan ketidakcekapan dalam perniagaan, sekali gus meningkatkan produktiviti. Oleh itu, artikel ini menyimpulkan bahawa amalan pengauditan di seluruh dunia akan mendapat manfaat yang besar jika Sistem Sokongan Keputusan dan Sistem Pakar dilaksanakan dengan sewajarnya. Untuk merealisasikan ini, juruaudit mungkin memerlukan latihan tentang pelbagai fungsi sistem. Memandangkan sistem berkembang maju berdasarkan nilai dan sifat data yang dimasukkan ke dalamnya, juruaudit mungkin perlu lebih teliti dengan sifat data yang disediakan dalam sistem.

Introduction

In ' 'today's increasingly complex corporate transactions, multinational operations, and stringent regulatory oversight, auditing has become more important than ever for ensuring reliable financial reporting. The term "audit" refers to checking, investigating, and closely examining a ' 'company's financial records (Byrnes et al., 2018). The goal of auditing is to offer an unbiased and independent evaluation of a ' 'company's financial records, internal controls, and general business operations to detect and prevent errors and fraud (Gaddis, 2018). The process involves auditors conducting a systematic review and verification of a ' 'firm's books of accounts, transaction records, and other pertinent documents, as well as physical inspection of inventories (Byrnes et al., 2018).

The process of auditing has evolved in the last century, culminating in an expansion from the traditional roles of auditing. Consequently, ' 'today's auditors are expected to do more than just increase financial statement trustworthiness; they must also bring value to their 'clients' operations (Teck-Heang & Ali, 2020). Ensuring financial reporting is accurate, reliable, and transparent is becoming more difficult for auditors in ' 'today's fast-paced business environment (Lois et al., 2019). Despite its importance, auditing in ' 'today's complicated business world is challenged by various difficulties. Auditors face various challenges that may make it difficult for them to accurately evaluate and give Assurance on financial accounts (Oyewo et al., 2020). With the advancement of technology, it is becoming more challenging to identify fraudulent actions throughout the audit process since they can be purposefully camouflaged (Feng et al., 2022). Further, with the increasing complexity of businesses (Appelbaum et al., 2018), sophisticated transactions, varied operations, and evolving accounting practices, the auditing function may need to adapt to stay relevant (Bonyuet, 2020). Understanding and evaluating complicated financial instruments, business structures, and accounting practices are challenges that auditors must overcome today.

Auditors are accepting artificial intelligence systems (AIS), such as Decision Support Systems (DSS) and Expert Systems, to manage these complexities (Mohammed et al., 2019a; Mazo et al., 2020). These systems are revolutionising the auditing field, expanding 'auditors' capabilities, and improving the audit process as a whole, as they are driven by artificial intelligence and advanced analytics (Bonyuet, 2020). The implementation of intelligent decision support systems based on expert systems, decision support systems, and Machine Learning could potentially enhance the quality of audits and reduce the level of audit risk.

Nevertheless, literature on the impact of artificial intelligence, specifically expert systems and decision support systems, on auditing is limited. The studies focused on AI's potential rather than its actual impact. This article intends to investigate the significant impact of Decision Support Systems and expert

systems on auditing through a systematic review approach. Following this introduction, the article provides conceptual literature and theoretical literature related to the use of expert systems and decision support systems in auditing. The article then conducts a thorough examination of the empirical evidence regarding ' 'AI's impact on auditing. The paper further explores the practical implications and concludes with suggestions for future research.

Literature Review

Conceptual Literature

The auditing industry, like many others, has been profoundly impacted by the lightning-fast development of technology. The purpose of this literature review is to delve into the vast amount of work done to date, highlighting how expert systems and Decision Support Systems have had an impact on the auditing industry.

Expert System

Expert systems are software programs that are programmed to mimic the performance of human experts in a given field (Berdiyeva et al., 2021). Expert system auditing is a radical departure from traditional auditing practices. The purpose of an expert system in an auditing situation is to simulate the analytical reasoning and problem-solving skills of human auditors. These tools incorporate the knowledge of seasoned professionals to help auditors better analyse risks, weigh evidence, and come to well-informed conclusions (Berdiyeva et al., 2021).

Components of expert system

The literature on the components of expert systems provides a fundamental understanding of the technological framework supporting these AI tools and their use in auditing. Expert systems are complex systems made up of several components that are created to mimic and enhance the problem-solving abilities of human auditors. This, therefore, has brought a significant change in traditional auditing methods. Expert systems could not do their task of analysing complicated issues, deciding on appropriate courses of action, and recommending suitable solutions without these essential parts.

Inference engine

An expert system's inference engine handles all of the thinking and deliberation based on available rules and information. The inference engine is the central component of an expert system, utilising a range of computational and logical techniques to extract relevant information from the knowledge base, imitating the cognitive abilities of human experts. The inference engine utilises many inference techniques including forward chaining, backward chaining, and fuzzy reasoning to navigate intricate audit scenarios. These techniques evaluate risk variables and reach well-founded conclusions. The inference engine improves the ' 'system's capacity to extract practical insights and recommendations from various data sources (Mohammed et al., 2019b).

Knowledge base

The heart of any expert system is its knowledge base. This component acts as a repository of domain-specific information that is carefully gathered from experienced individuals or research. The knowledge base functions as the central cognitive component of the system, containing a vast amount of specialised knowledge, facts, rules and algorithms. This is organised in a structured way to enable the base to obtain the necessary data to carry out comprehensive risk analyses, assess evidence and make well-informed decisions. The structure also allows for efficient retrieval and processing of data, enabling auditors to navigate complex audit scenarios with precision and accuracy. (Mohammed et al., 2019b)

User interface

The user interface is the link between the expert system and end users. The user interface enables auditors to input pertinent data, ask questions and obtain practical insights from the system by employing intuitive design concepts and user-friendly

features. The user interface improves the auditing process by making interactions more efficient, which leads to better decision-making and knowledge sharing. Additionally, the user interface functions as a channel for rapid feedback and cooperation. This promotes an active exchange of information between auditors and expert systems (Mohammed et al., 2019b).

Knowledge acquisition system

The expert system's knowledge base is developed and maintained by the knowledge acquisition system. This component is responsible for facilitating the currency and relevance of its knowledge repository. This is done through the acquisition, validation and integration of domain-specific expertise from human auditors, subject matter experts and external sources. The knowledge acquisition system uses methods such as interviews, document analysis and machine learning algorithms to systematically gather and combine new knowledge. This allows the expert system to adjust and respond to changing audit situations and emergent challenges.

Explanation facility

The explanation facility is a crucial component that provides a clear and understandable explanation of the reasoning behind the ' 'system's judgement and recommendations. The explanation facility improves the credibility and trustworthiness of the ' 'system's outputs by offering clear explanations of the decision-making process. Auditors can acquire a deeper understanding of the fundamental principles and thought processes utilised by the expert system. This promotes well-informed decision-making and encourages cooperation between human auditors and automated systems. In addition, the explanation facility enhances accountability and transparency of the audit trail, allowing auditors to confidently verify and audit the ' 'system's results.

Application of expert system in auditing

Auditors can use the assistance of expert systems to better assess the risks related to a company's operations and financial reporting. Expert systems can assist auditors in identifying potential areas of risk by assessing historical data, industry trends, and regulatory requirements (Hasan, 2022).

Auditing is complicated by the presence of fraud. Financial data can be analysed by expert systems for irregularities, outliers, and signs of fraud. These technologies can detect potentially fraudulent dealings by employing complex algorithms and machine learning methods, allowing auditors to focus on the most dangerous spots (Feng et al., 2022).

Compliance with applicable rules, regulations, and industry standards can be verified with the help of expert systems used by auditors. Expert systems can provide real-time updates and recommendations by constantly monitoring changes in legislation, allowing auditors to proactively resolve compliance issues (Hasan, 2022).

There are several upsides to employing expert systems in auditing, but doing so also presents challenges and difficulties (Hasan, 2022). Expert systems must be tested and validated thoroughly to ensure their accuracy and reliability. During deployment, it is important to assess how well the audit system integrates with pre-existing infrastructure and how well it works with various data sources. In addition, auditors should use their best judgment when weighing the ethical implications of their actions and interpreting the results of expert systems (Ghanoum and Alaba, 2020).

Decision Support System (DSS)

During an audit, auditors may make use of various computer-based techniques and technologies known as decision support systems (DSS) (Hasan, 2022). DSS consists of a set of interconnected elements, each with a specific function in utilising data analytics, visualisation tools, and sophisticated algorithms. Altogether, they help to analyse and understand audit-related data for risk assessment, pattern recognition, and insight generation (Hasan,

2022). DSS's purpose is to increase audit quality and efficiency by increasing auditors' capacity for sound decision-making.

Components of decision support system (DSS)

The Decision Support System (DSS) components collaborate to collect, process, analyse, and present data in a meaningful way so that users can weigh their options, weigh the consequences of their actions, and make educated decisions.

Model management

The primary component of a DSS is model management, which is responsible for creating, maintaining and executing decision-making models and algorithms. The spectrum of models available includes both simple spreadsheets and sophisticated simulation and optimisation programs. These models allow auditors to analyse different situations, evaluate potential outcomes and make well-informed judgements. Model management enables auditors to successfully utilise analytical approaches by enabling suitable models. This in turn, enhances the rigor and accuracy of decision-making processes (Corporate Finance Institute, 2023).

Data management

The data management component entails accumulating and filing away information in a systematic and efficient manner. Data management guarantees the accessibility of precise, prompt and pertinent information from many sources, allowing auditors to get full understanding of audit-related data. Data management uses techniques such as extraction, transformation, and loading (ETL), integration, and maintenance of databases to ensure standardisation (Rashidi et al., 2018). This allows auditors to have a comprehensive understanding of audit processes and results (Corporate Finance Institute, 2023).

User interface

The user interface is the point of contact between the Decision Support System and end users. The intuitive interface makes it simple to enter data, establish criteria for making decisions, navigate models, and view the outcomes of analyses. The user interface improves the auditing process by making it easier for users to make decisions and share information. This results in more efficient decision-making and knowledge sharing (Corporate Finance Institute, 2023).

Knowledge base

The knowledge base functions as a storage facility for specialised information and regulations, allowing the DSS to tap into the vast amount of experience when making decisions. This component offers auditors useful insights into audit methods, industry trends and regulatory requirements through housing rules, historical data and other pertinent information. This would help make well-informed decisions, evaluate risks and pinpoint opportunities for improved process efficiency, therefore improving the quality and dependability of audit results (Corporate Finance Institute, 2023).

Decision support generator

The decision support generator is a crucial element of DSS. It converts user input and accessible data at hand into a set of practical insights and recommendations. The decision support generator assists auditors in analysing alternatives, considering trade-offs and determining the best courses of action. This is done through the use of algorithms, rules or decision trees. The decision-making generator helps auditors make data-driven judgements through its analytical capabilities (Rashidi et al., 2018).

Collectively, the parts of a Decision Support System equip users with the data, methods, and simulations they need to make educated choices. Decision Support Systems enable users to analyse complex problems, explore alternatives, and evaluate potential outcomes by utilising data management, model management, a knowledge base, a user-friendly interface

and decision support generation (Corporate Finance Institute, 2023).

Application of decision support system in auditing

Decision Support Systems (DSS) can help auditors discover fraudulent actions or irregularities within financial transactions. The DSS employs sophisticated analytics and data mining methods to analyse large amounts of data, enabling it to detect irregularities such as duplicate payments, fraudulent vendors, and abnormal financial transactions. This assist auditors in identifying potentially fraudulent actions, therefore improving the integrity and dependability of audit results (Hasan, 2022).

Financial analysis and evaluations are facilitated by the integration of financial analysis tools into DSS. This allows auditors to conduct thorough examinations of financial information. Methods such as ratio analysis, trend analysis, and benchmarking aid in assessing financial performance and liquidity and profitability indicators. DSS improves 'auditors' capacity to interpret and analyse intricate financial information by presenting it in a well-organised and interactive manner. This further facilitates informed decision-making and boosts the effectiveness of audits (Rashidi et al., 2018).

A Decision Support System can help auditors evaluate and identify potential threats to a ' 'company's financial procedures. This can be done through the examination of historical data, transaction patterns and other relevant information. DSS employs probabilistic modelling and scenario analysis to allow auditors to evaluate the probability and seriousness of various risks. This helps in the planning and prioritisation of audits to enhance their efficiency and efficacy by offering insights into developing risks and vulnerabilities. This allows auditors to implement proactive tactics for mitigating these risks (Rashidi et al., 2018).

Decision Support System can help auditors keep track of their audit's steps, results, and conclusions. The Decision Support System makes it easier to create thorough audit reports and maintain consistency in documentation throughout audit engagements by providing templates, recommendations, and automated report preparation tools (Rashidi et al., 2018).

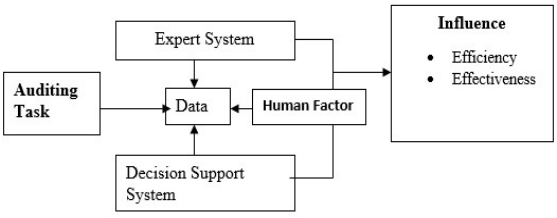
Auditors may use the Decision Support System to facilitate ongoing monitoring and auditing procedures. Decision Support Systems can assist auditors in proactively identifying control flaws, operational inefficiencies, or developing risks by utilising real-time data feeds, automatic warnings, and exception reporting (Rashidi et al., 2018).

While Decision Support Systems can be a helpful addition to the audit process and provide significant insights, they are not meant to replace the auditor's independent judgment and experience. The purpose of a Decision Support System is to aid auditors in making choices, not to make those decisions for them.

Based on the discussions made so far, Figure 2 below depicts the conceptual frameworks. This framework provides an overview of the understanding gathered from both theory and concepts discussed so far. In particular, the framework suggests that depending on the auditing task, expert systems and decision support systems will use data fed into the system by a human (e.g. an auditor). Based on this, the Expert system and the decision support system are expected to influence the efficiency and effectiveness of the auditing process.

Figure 1

Conceptual framework depicting the influence of DSS and ES on Auditing



Theoretical Literature

The Task-Technology Fit Theory

The task-technology fit theory (TTF) is a theory that suggests that the effectiveness of technology in the workplace depends on the fit between the technology and the tasks that are being performed (Spies et al., 2020). In the context of auditing, TTF suggests that the effectiveness of decision support systems (DSS) and expert systems will depend on the fit between these systems and the tasks that auditors perform.

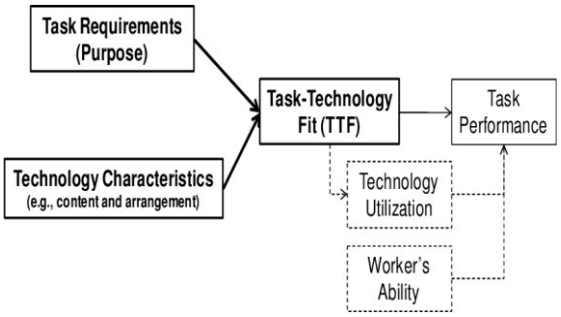
Based on this theory, the fit between DSS and expert systems and the tasks that auditors perform can be assessed in terms of several factors, including the following: The complexity of the tasks, the level of uncertainty, the nature of the tasks and the skills and knowledge of the auditors (Hidayat et al., 2021) as depicted in Figure 1 below. Suppose the fit between DSS and expert systems and auditors' tasks is high. In that case, these systems are more likely to be effective in improving the efficiency and effectiveness of auditing. However, these systems are less likely to be effective if the fit is low.

The TTF theory has several implications for using DSS and expert systems in auditing. First, it suggests that auditors must carefully consider the tasks they perform when choosing a DSS or expert system (Erskine et al., 2019). Second, it suggests that auditors need to be trained to use these systems effectively. Third, it suggests that auditors need to monitor the performance of these systems to ensure that they are still effective (Erskine et al., 2019).

The TTF theory is a valuable tool for understanding the influence of technology on auditing. It can help auditors choose the right DSS or expert system for their needs, train their staff in how to use these systems effectively and monitor the systems' performance to ensure that these systems can effectively influence auditing.

Figure 2

Main construct of the TTF theory (Browning, 2010).



Empirical Literature

Rodrigues et al. (2023) conducted a study on the impact of artificial intelligence on the audit profession. The main purpose of this study was to evaluate the impact of applying AI to the auditing industry. It presented the findings of a questionnaire survey to find out certified auditors' opinions about how artificial intelligence is affecting the audit profession in Portuguese districts. Auditors in the Porto and Braga regions are the primary target demographic. This approach seemed more reasonable and acceptable since it facilitates easy data comparability, permits quantitative analysis, and provides a more straightforward means of dealing with the data statistically. Therefore, the surveys were administered using a five-point Likert scale. The results show that respondents think the deployment of AI will determine the profession's future, specifically in the efficiency and efficacy of audit methods, sample methodologies, cost-benefit analysis, and the ability to detect material distortions. It seems to be generally accepted that AI will affect the current audit approach, with repercussions in terms of efficiency and effectiveness of audit procedures, audit sampling, recognising material misstatements due to fraud or error, and the cost-benefit ratio of the profession. In addition, auditors understand that the incorporation of these technologies into the industry could pave the way for ongoing auditing.

Ghanoum and Alaba (2020) performed research on the integration of

artificial intelligence in auditing and its effect on the auditing process. The goal of this research is to better understand how auditing processes can be improved through the use of artificial intelligence-based solutions. This research is qualitative. The method used was abductive. Auditors from Swedish auditing firms that have implemented the usage of AI-based tools in their audit process were interviewed through a semi-structured questionnaire to obtain the data utilised in the study. The exponential growth of data is forcing auditors to improve processing capability while keeping audit effectiveness and reliability. Researchers found that using AI systems improved efficiency throughout the entire audit process, boosted professionalism, and improved adherence to auditing standards. The study recommended AI-enabled auditing solutions over more conventional auditing methods.

Zemánková (2019) studied artificial intelligence and blockchain in audit and accounting. The primary objective of this article was to examine the areas of audit, such as risk assessment, that can be improved with the help of artificial intelligence. This study employed a literature search for similar articles concerning artificial intelligence, accounting, and auditing. Findings showed that the use of blockchain technology in the audit was also studied. Decision-making and the selection and evaluation of samples are also necessary for auditing jobs. As a result, incorporating AI into the audit process has the potential to boost productivity and, once again, eradicate human mistakes. Artificial intelligence (AI) could be useful during audit phases that call for the execution of rules-based tasks, especially the more laborious ones. According to the results, using AI in accounting and audit has great potential to improve efficiency, cut down on errors, and free up accountants' and auditors' time to focus on more complicated and value-added duties. The future of corporate transactions and auditing may lie in the efficient automated execution of smart audit procedures and smart contracts.

Berdiyeva et al. (2021) conducted a study on artificial intelligence in accounting and finance meta-analysis. The purpose of this study was to present a meta-analysis of the literature review, which is a methodical and in-depth approach to searching for and analysing relevant literature on a certain topic, such as the effect of AI applications on the accounting and finance process. All papers used in this analysis were found through an exhaustive search of academic databases for the term "artificial intelligence in accounting and finance." Artificial intelligence is crucial to the success of the accounting and financial industries in the future. Artificial intelligence (AI) is a crucial resource for providing these workers with the tools they need to be more efficient and productive in their jobs. The study found that AI applications, such as an "Expert System" or "Intelligent Agent," can greatly benefit the accounting and finance industry by cutting down on human error, speeding up the audit process, decreasing audit costs, and saving both time and money on the process of teaching accounting novices. Most academics, based on their analyses, concluded that implementing AI technology into the bookkeeping procedure would increase efficiency. 'According to the study, usage of AI was found to improve accountants' and auditors' efficiency.

El-Dalabeeh and AlZughoul (2020) aimed to identify the impact of expert systems in improving the general controls of computerised accounting information systems in the Jordanian industrial public shareholding companies listed on the Amman Stock Exchange. To achieve this goal, the researchers depended on descriptive and analytical approaches. The study population consisted of all Jordanian industrial public shareholding companies, and the study sample was selected from companies using expert systems, which numbered 32 companies. A questionnaire was formulated and distributed in 140 copies. SPSS was used to analyse data. The researchers found that there is an impact of expert systems in improving the general controls of the computerised accounting information systems' four pillars: regulatory controls, access controls,

controls for the security of files, documentation of controls and the development and maintenance of devices. Based on the result, El-Dalabeeh and AlZughoul (2020) recommended that there is a need to develop training programs for the staff of Jordanian industrial companies to increase their awareness and understanding of the uses of expert systems, as this could assist them in avoiding errors during system use and consequently lead to strengthening general controls in the companies.

Song et al. (2017) investigated the efficacy of a decision support system (DSS) in enhancing risk assessment performance. The study used a laboratory experiment with 112 audit seniors who were randomly assigned to either the DSS condition or the control condition. The DSS condition participants used a DSS to assess the risk of material misstatements in financial information, while the control condition participants assessed the risk of material misstatements without using the DSS. The results of the study showed that the DSS condition participants performed significantly better than the control condition participants on a risk assessment task. The DSS condition participants were also more likely to identify high-risk areas and to recommend appropriate audit procedures. The study's findings suggest that DSS can be an effective tool for enhancing risk assessment performance. The DSS provided the participants with access to relevant information and helped them to organise and analyse this information in a systematic way. The DSS also provided the participants with feedback on their risk assessment decisions, which helped them to improve their decision-making skills. The study's findings have implications for the use of DSS in auditing. The findings suggest that DSS can be a valuable tool for auditors, but they also highlight the importance of designing DSS that are tailored to the specific needs of auditors. The DSS used in the study was designed specifically for risk assessment, and it is likely that other DSS would need to be designed for different auditing tasks. Overall, Song et al. (2017) provide evidence that DSS can be an effective tool for enhancing risk assessment performance. The findings of the study have implications for the use of DSS in auditing, and they suggest that DSS can be a valuable tool for auditors.

Gaps in Literature

The studies demonstrate limited geographic scope, focusing on specific regions or industries. As a result, there is a possibility that these studies may fail to consider wider patterns and differences in auditing methods. The literature focuses on efficiency or risk assessment without thoroughly investigating their wider consequences throughout the entire audit procedure. Therefore, there is a need to expand the geographic coverage and adopt a comprehensive approach to understanding the role of technology in auditing. This would help provide a better knowledge of expert systems and decision support 'systems' influence and enable informed decision-making in audit technology.

Methodology

This article aimed to explore the influence of expert systems and decision support systems on auditing. This article reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) with a PRISMA flowchart.

Eligibility Criteria

The article included studies that specifically focused on the impact of expert systems and decision support systems on the field of auditing. Studies considered eligible included original research, observational studies, experimental studies, quasi-experimental studies and peer-reviewed articles. The studies were published in the English Language and focused on the influence of expert systems and decision support systems on auditing. The review excluded studies that did not involve the impact of expert systems or decision support systems in auditing.

Information Sources

The article conducted comprehensive searches across multiple

electronic databases, such as PubMed, ScienceDirect, Business Source Complete (EBSCO), Scopus, and grey literature from Google Scholar, to gather relevant sources and studies. The search period extended from June 2020 to May 2024.

Search Strategy

The search strategy involved employing a combination of keywords pertaining to auditing. The following terms were used: "auditing", " expert systems", "decision support systems", and "influence". The search was tailored for each database to maximise the retrieval of pertinent studies. Filters were employed to ensure the relevance and up-to-date nature of the data, incorporating research that has been published over the last five years.

The articles that were identified were imported into the reference management programme, and any duplicate articles were eliminated. The titles and abstracts of the studies underwent a screening procedure to determine their eligibility. Subsequently, the texts of articles that fulfilled the initial criteria were assessed according to the predetermined criteria for inclusion and exclusion.

Selection Process

Initially, articles sourced from several texts were employed as a tool for reference management software in order to minimise redundant entries. The review procedure consisted of two screening stages. During the initial round, two reviewers independently assessed the paper titles and abstracts based on the predetermined criteria. Articles that did not fit these specific criteria were not included, and the reasons for their absence were recorded. During the second round, two reviewers evaluated the remaining articles comprehensively, using predetermined criteria. Conflicting perspectives were resolved through discourse or by seeking input from a third reviewer. The meticulous selection method guaranteed that only the most pertinent and high-quality articles were incorporated into the systematic review. This bolstered the reliability and validity of the findings.

Data Collection Process

The data collection process was meticulously planned to guarantee the precision and comprehensiveness of the data acquired from the chosen studies. The responsibility of gathering data from each study that satisfied the inclusion criteria was delegated to two autonomous reviewers. The primary objective of this article was to collect data on the influence of expert systems and decision support systems on auditing.

The reviewers utilised a standardised data extraction form that encompassed various aspects such as study characteristics, details of expert systems and decision support systems and their impact on auditing. In order to achieve clear and consistent results, a preliminary study was carried out on a smaller sample of the studies to evaluate the data extraction form.

Study Risk of Bias Assessment

The studies' quality was evaluated using the Cochrane Collaboration tool for assessing the risk of bias in randomised trials and the Newcastle-Ottawa Scale for non-randomised studies. The evaluations examined various crucial aspects, such as selection bias, performance bias, and other potential sources of prejudice. Two autonomous reviewers evaluated the potential for bias in each paper that was included. The categorization of each domain was determined based on the given criteria outlined by the assessment tools, resulting in classification as either 'Low Risk', 'High Risk' or 'Unclear Risk'. Any discrepancies in the evaluation carried out by the two reviewers were addressed through a deliberate process or, if needed, by seeking the viewpoint of a third reviewer. This approach guaranteed a thorough, organised and impartial examination of the literature regarding the influence of expert systems and decision support systems on auditing. This was in accordance with the criteria specified in the PRISMA 2020 checklist.

Results and Discussion of Findings

Study Selection

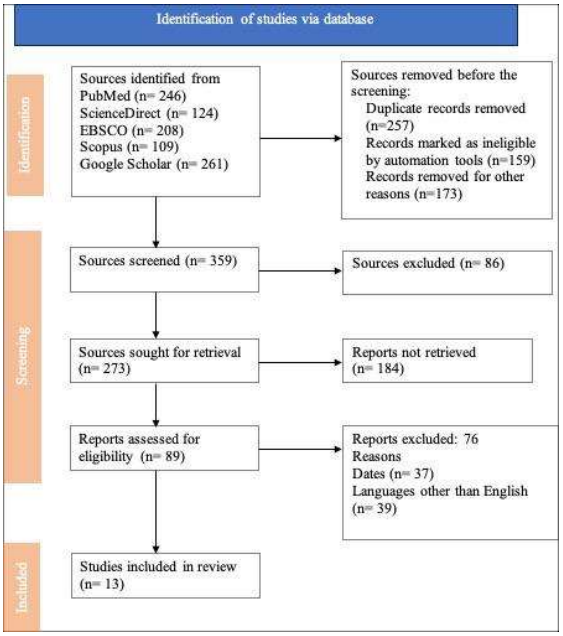
Figure 3 illustrates the procedures associated with the selection of the papers that were reviewed. A total of 948 studies were retrieved from several databases, including Google Scholar, PubMed, ScienceDirect, Business Source Complete (EBSCO) and Scopus. A total of 257 duplicate records were removed, 159 were identified as ineligible by automation approaches, and 173 were excluded for various other reasons.

In the subsequent stage, 359 sources were filtered with the exclusion of 86. The figure does not include explicit details regarding the grounds for exclusion at this level. However, the criteria for exclusion encompass factors such as relevance and appropriateness in relation to the present study. In order to narrow down the selection, the article attempted to find 273 reports for a comprehensive search but 184 of them were not accessible due to worries about availability. After collecting 89 studies, the articles assessed their relevance, methodological soundness and review scope to evaluate their eligibility. This evaluation rejected 76 papers due to their obsolescence (37), being written in a language other than English (39), or involving a population that did not fulfil the criteria.

Following a rigorous screening and evaluation process, only 13 studies met the criteria for inclusion in the systematic review. The low number indicates the stringent criteria employed to guarantee that the review was founded on the most pertinent and superior quality evidence and addressed the research question.

Figure 3

PRISMA Flowchart



Synthesis of Results

The synthesis of the results in this systematic literature review employed a thematic analysis technique, integrating findings from several studies to offer a thorough comprehension of the influence of expert systems and decision support systems on auditing. The synthesis was organised based on three primary themes: The impact of technology on auditing, the Role of artificial intelligence and decision support systems, and the challenges and limitations of technological implementations.

Table I

Summary of Thematic Analysis

Main Themes	Impact of technology on auditing	Role of Artificial Intelligence and Decision Support System	Challenges and Limitations of Technological Implementation
Subthemes	Evolution of audit processes Increased efficiency and effectiveness Pressure on auditors to adapt to	Data analysis and interpretation Time efficiency and error reduction	Access to specialists and resources Cost, complexity and accuracy issues Misconceptions and training needs.

technological changes	Assurance of financial statement.

Discussion

Technology and the rising use of artificial intelligence systems, such as expert systems and decision support systems, are driving the evolution of the audit, building on the innovations that computers brought to the assurance profession (Hasan, 2022) (such as transferring ticking and calculating from hard copy ledger paper to electronic working papers). There is no denying that the advancement of technology has had far-reaching effects on people's personal and professional lives over the years. The evolution of the economy and the size of organisations make the execution of manual procedures increasingly unfeasible (Ghanoum and Alaba, 2020); however, the development of AI portends significant changes in the most diverse areas of human knowledge, particularly in the auditing sector (Rodrigues et al., 2023). CPAs (Chartered Professional Accountants and Certified Public Accountants) providing audit and assurance services are feeling the pressure to adapt quickly to the new data-driven landscape (CPA Canada, 2020). More than ever, both auditors and the organisations they examine rely on cutting-edge technological tools (CPA Canada, 2020). Modern computing power (and its accessibility), machine learning, and AI-enabled audit tools allow for the analysis of massive data sets in search of abnormalities and the discovery of insights, patterns, and linkages that would otherwise be invisible to the human eye (Mohammed et al., 2019b). AI systems involve human judgement and experience to interpret the results, confirm that the data represents a genuine anomaly, and draw conclusions about what the anomalies, insights, or patterns mean in the bigger picture (CPA Canada, 2020). This implies that auditors spend less time on data collection, analysis, and summarisation. Instead, they focus on concluding the data and information gathered. This information could be useful for guiding the audit strategy at an early stage.

Errors that previously caused auditors to redo their work have been eliminated with the use of modern technology, such as expert systems and decision support systems (Chukwudi et al., 2018). Financial records are just one type of data that may be collected and properly analysed by AI systems. Routine tasks that require a lot of human effort and present opportunities for human error, manipulation, and omission are prevented by the use of AI (Berdiyeva et al., 2021). According to the results of the literature review, AI is beneficial since it provides benchmark tools that are helpful in the examination of general ledger transactions (Ghanoum and Alaba, 2020). AI is helpful in this way since it highlights potential trouble spots that need fixing. Manual auditing is less efficient because it relies on random sampling for analysis (Ghanoum & Alaba, 2020)

However, not all audits and businesses have ready access to specialists, CS engineers, and data scientists who can develop in-house AI-enabled products (CPA Canada, 2020). Fortunately, tailor-made solutions are not necessary, and plenty of ready-made software options exist (Husain, 2019). Depending on needs, available resources, and available time, auditors and businesses can choose the optimal course of action (Hasan, 2022). More accountants and businesses will be able to provide better service to current and prospective customers as AI and automation continue to advance. In addition to facilitating greater standardisation across similar engagements, AI may also make it possible to check quality across a wide range of activities (CPA Canada, 2020).

However, it is a common misconception that the AI tools available today are inherently intelligent and omniscient. Carefully developing effective AI tools that provide value within a certain, constrained domain, such as locating patterns in relatively clean data that can be used to make valuable predictions, requires a large amount of data and a

considerable amount of effort. While artificial intelligence engines can quickly process millions of records once they are ready, the extent of this "processing" is still somewhat limited (Hasan, 2022). An artificial intelligence programme built for anomaly identification, for instance, might not recognise a transaction as such because of money laundering (CPA Canada, 2020). Gaining access to and permission to use needed client data sets, especially data that may contain confidential or personally identifiable information, or obtaining the data in a usable format (data may need formatting or cleansing), are additional challenges when it comes to training and fully benefiting from the power of AI (CPA Canada, 2020).

Particularly for Decision Support Systems (DSS), the review has shown that DSS largely influence auditing. It does so by improving efficiency and helping auditors to analyse and interpret data more efficiently (Song et al., 2017). This can free up auditors' time so that they can focus on more complex and challenging tasks. It has also improved effectiveness by assisting auditors to identify potential risks more effectively and to design audit procedures more efficiently. This has led to more reliable and accurate audit reports. Lastly, increased assurance helps auditors provide increased assurance to their clients that their financial statements are free from material misstatement.

However, there are also some challenges associated with the use of DSS in auditing, including the cost of development of DSS and the complexity of DSS, which may require auditors to be trained in how to use them effectively, which will further increase cost. Also, the accuracy of DSS is not certain (Song et al., 2017). DSSs are only as accurate as the data on which they are based. Thus, if the data is inaccurate, then the results of the DSS will also be inaccurate. As postulated by the task-technology fit theory, the ability of the users (e.g., auditors, IT staff) to use technology also plays a vital role in the efficient use of technology. As such, the quality of personnel developing the DSS is key to ensuring its effectiveness in auditing.

Similarly, the review suggests that expert systems significantly influence auditing. It does so by providing auditors with access to the expertise of human experts. This can be especially helpful in areas where auditors lack expertise, such as complex accounting issues (Okab, 2013). In this sense, the task-technology fit theory has argued that the ability of technology to solve complex problems makes the technology effectively influential on the task (auditing) assigned to it. More so, expert systems enable auditors to make better decisions by providing them with insights that they would not have been able to obtain on their own (El-Dalabeeh & AlZughoul, 2020). This, thus, reduces the risk of human error by automating routine tasks and by providing auditors with guidance on how to make decisions. Nonetheless, there are also some challenges associated with the use of expert systems in auditing, such as cost, complexity, and accuracy, just as discussed for DSS.

Overall, the research on the impact of DSS and expert systems on auditing is promising. These systems have the potential to improve the efficiency, effectiveness, and assurance of auditing. However, there are also some challenges associated with the use of these systems, and auditors need to be aware of these challenges before they decide to use them. Recent research has also focused on the use of DSS and expert systems in specific areas of auditing, such as fraud detection and internal control assessment. This article has shown that these systems can be effective in these areas, but more research is needed to determine their full potential. Also, the use of DSS and expert systems in auditing is still in its early stages. However, this article that has been conducted so far suggests that these systems have the potential to significantly improve the efficiency, effectiveness, and assurance of auditing. As these systems continue to develop, they are likely to become even more important in the future.

Conclusion and Policy Recommendations

The integration of expert systems and decision support systems (DSS) has transformed the auditing sector, providing auditors with unprecedented speed, accuracy and reliability in their tasks. These technologies have reduced errors and identified unnoticed hazards. The technologies also presented new challenges like technical expertise, adapting to changing technology environments and addressing data security and privacy issues. Policymakers should focus on integrating expert systems and decision support systems into auditing practices to enhance auditors' technical competencies and ensure effective use. This could involve investing in training programmes, collaborating with industry stakeholders to develop robust data security and offering incentives to audit firms. The impact of expert systems and DSS on auditing practices requires further research on the evolving technical expertise required by auditors to effectively utilise these technologies. This would provide insights for audit firms and educational institutes in bridging the specific skills, training programs and learning mechanisms to ensure the full potential of the AI systems. Moreover, future research exploring regulatory compliance frameworks and best practices for data integrity and confidentiality could enhance trust and adoption among stakeholders.

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