Developing a Model for Audit Documentation Quality Using Internet-Based Technologies Based on a Grounded Theory Approach

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Abstract

The present study aims to develop a model for audit documentation quality using internet-based technologies based on a grounded theory approach. Methodologically, the study is descriptive-analytical and, in terms of its purpose, practical. Data collection methods include library research and field studies. In the qualitative phase, data collection tools included observations and interviews, while in the quantitative phase, a questionnaire was employed. The qualitative statistical population consisted of experts and specialists affiliated with the Iranian Association of Auditing. Data analysis from each in-depth interview was conducted using purposive snowball sampling until theoretical saturation and data adequacy were achieved (20 interviews were conducted to reach theoretical saturation). Sampling in the qualitative phase was performed non-probabilistically and purposively. In the quantitative phase of the study, aimed at validating the final model, the statistical population included all auditors from selected and accredited firms. The sample size for this phase was calculated using Cochran's formula, resulting in 373 participants. A combination of qualitative and quantitative methods was employed for analysis. In the qualitative phase, in-depth interview techniques were used, and in the quantitative phase, interpretive structural modeling (ISM), structural equations modeling (SEM), and fuzzy DEMATEL and fuzzy ANP techniques were applied. Using the interview technique, nine criteria were identified, and strategies for audit documentation quality using internet-based technologies were proposed based on a grounded theory approach. Interpretive structural modeling and structural equations modeling elucidated the relationships between variables and the preliminary model framework. The fuzzy DEMATEL results revealed that "organizational factors" had the most significant impact on audit documentation quality using internet-based technologies compared to other factors, with "managerial factors" ranking second. Additionally, "supervisory and technological factors" were the most influenced by other factors. Fuzzy ANP results indicated that organizational factors were the highest priority, followed by long-term relationships, with other criteria ranking third.

Keywords: *Audit Documentation*, *Internet-Based Technologies*, *Big Data*, *Information Technology*, *Audit Quality*.

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1. Introduction

Digital transformation impacts all sectors of society, especially the economy and business. Companies are now presented with an opportunity to entirely reshape their business models using new digital technologies, such as social networks, mobile technologies, big data, the Internet of Things (IoT), and other innovations like blockchain [1, 2]. Digital transformation encompasses changes in core business operations, refinement of products and processes, and organizational structures, requiring companies to adapt their management practices to navigate these complex transformations. As a result, society is undergoing a fundamental shift due to the development and widespread implementation of digital technologies in all markets [3, 4].

Due to globalization and the pressure to digitalize ahead of competitors, organizations face intense competition and aim to sustain their existence while achieving competitive advantages in the digital era. The phenomenon of digital transformation has been extensively studied across various academic domains, resulting in a comprehensive review of the field. However, there is no consensus on a comprehensive definition of digital transformation in business models—specifically, how business model digitalization should be structured, which stages and tools should be considered, and what models and enablers exist in this context [5, 6].

According to Audit Standard No. 230, audit documentation that complies with the requirements of the standard and specific provisions of related standards provides evidence supporting the auditor’s conclusions regarding achieving overall audit objectives, performing the audit in accordance with auditing standards, and complying with legal and regulatory requirements. Additionally, audit documentation demonstrates that the audit was conducted in compliance with established standards, including external and internal quality controls. An audit file, as defined in Audit Standard No. 230, may consist of one or more folders or other data storage tools, either physical or electronic, containing records that form the audit documentation. The standard defines audit documentation as "records of procedures performed (including audit planning, analytical methods, management confirmations, etc.), audit evidence obtained, and conclusions reached by the auditor." [7-9].

According to Audit Standard No. 230, the form, content, and extent of audit documentation depend on factors such as the nature of audit procedures, identified material misstatement risks, the level of judgment required to perform and evaluate the work, the significance of audit evidence obtained, the nature and extent of identified exceptions, the need to document conclusions, and the methodologies and tools used in the audit. The International Standards on Auditing (ISA) emphasize that audit documentation is vital for providing adequate and appropriate records to support the auditor's report and demonstrating that the audit was planned and executed per standards and legal and regulatory requirements. Documentation prepared during the execution of the work is more accurate than documentation prepared afterward, enhancing audit quality and enabling effective review and evaluation of obtained audit evidence. High-quality audit documentation facilitates the finalization of conclusions before issuing the audit report. These standards encompass objectives, requirements, implementation methods, and additional explanatory material to guide auditors in preparing audit documentation. However, comprehensive research into the quality of audit documentation, its characteristics, and influencing factors, particularly through qualitative approaches and in-depth expert interviews, remains scarce [10, 11].

One domain profoundly influenced by internet-based technologies is auditing and financial operations. Financial and audit automation, a component of modern technology, significantly simplifies the most time-consuming elements of accountants’ daily tasks. These systems, commonly known as computer-assisted audit tools, perform numerical calculations and transaction tracking on behalf of businesses. Automation reduces human errors and clarifies financial processes. By minimizing time-consuming manual tasks, such as spreadsheets and data aggregation, accountants can save time, energy, and money [12]. Cloud-based auditing and financial services have become highly popular. The rising demand for remote work in the industry has increased the reliance on cloud-based technologies, ensuring companies and businesses operate efficiently worldwide.

Artificial intelligence (AI) has also brought transformative changes to the auditing processes of organizations. This technological trend enhances efficiency while reducing the time required for numerical processing [13]. Blockchain provides infrastructure to securely record transactions on multiple distributed ledgers, eliminating the potential for data tampering. This capability is crucial for auditors, as it eliminates the need for various tests to ensure data accuracy and allows auditors to directly verify transactions [6].

In their study, Chu et al. (2024) revealed that auditors' willingness to issue General Compliance Auditing Reports (GCAR) is often used as an indicator of audit quality. However, while this willingness may distinguish auditors, it does not inherently reflect quality, as high-quality auditors tend to issue GCARs for deserving clients and avoid it for others. Their findings warn against using this willingness as a proxy for audit quality, as PCAOB inspection reports rarely list GCAR as a deficiency, instead attributing issues to evidence collection and estimates [14]. Han et al. (2023) discussed how blockchain technology can enhance transparency and trust in auditing by providing immutable, verifiable, and consensus-based data. They argue that blockchain can improve decision-making for auditors and interpret data reliability within AI systems, contributing to real-time auditing, continuous auditing, and event-driven approaches [15]. Hajiah and Hamysian Kashani (2024) presented a model to enhance the quality of auditing documentation, incorporating ethical and spiritual intelligence, and behavioral antecedents of audit partners [11]. Their results show that ethical intelligence, spiritual intelligence, and behavioral background directly impact audit documentation quality. Finally, Delbari Raghab and Ismailzadeh Maghri (2023) presented a model comprising four components and a triadic stakeholder classification, where the interaction among components impacts audit quality and increases public trust in financial information [16].

While various studies have highlighted the importance of information technology, particularly digital transformation, in improving audit processes, a lack (if not an absence) of a comprehensive model addressing the application of internet-based technologies in shaping accounting and auditing practices is evident. Most prior research has primarily established the positive impact of digital technologies on auditing performance, with limited attention to contextual factors, intervening variables, and strategies for implementing digital technologies in auditing. This study aims to develop a comprehensive model to address the role of internet-based technologies in shaping accounting and auditing practices using a grounded theory approach.

The primary issue in this research is the underutilization of the vast potential of information technology in auditing within the country. Compared to many other nations, Iran still has not extensively leveraged the high capabilities of information technology in auditing, despite its significant benefits. Modern technologies enable the analysis of previously unprocessable information, forming the basis for new auditing standards since financial statements alone cannot meet these demands [17]. For instance, blockchain has introduced fundamental changes to auditing. As a database technology, blockchain enables the establishment of a secure system accessible within a network without requiring a manager. It is updated based on specific rules and features an autonomous audit system where all transactions are reconciled. This feature has led to blockchain being introduced by the European Union as a solution for financial reporting. Blockchain can also easily validate and verify audit processes, which is crucial in auditing [18, 19].

Considering these factors, this research develops a model for audit documentation quality using internet-based technologies based on a grounded theory approach.

2. Methodology

The present study is applied in terms of purpose and descriptive-analytical in terms of nature. In the theoretical section, the required information was collected from various sources. Part of the data was gathered through library studies and the use of documents and reports, while the remaining data were compiled by visiting libraries of auditing faculties, consulting local specialists, and reviewing relevant documents and reports. For library-based studies, the tools for data collection included note-taking, tables, charts, maps, books, articles, and other sources. For field studies, a questionnaire was employed as the primary tool for data collection. The fuzzy DEMATEL and fuzzy ANP techniques were used to analyze the data.

3. Findings and Results

To examine the influential indicators of audit documentation using internet-based technologies, this study employed the fuzzy DEMATEL method. The steps of this method are detailed below:

Step One: In the first step, after identifying the selected influential factors and indicators for audit documentation using internet-based technologies, the experts' responses to these indicators were aggregated. The results were presented in a 9×9 matrix, as shown in Table 1.

Table 1. Initial Decision Matrix in the Fuzzy DEMATEL Method

Initial Matrix	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	(0,0,0)	(0.375, 0.125, 0)	(0.625, 0.375, 0.125)	(0.375, 0.125, 0)	(0.5, 0.25, 0)	(0.75, 0.5, 0.25)	(0.75, 0.625, 0.375)	(0.375, 0.125, 0)	(1, 0.875, 0.625)
Organizational Factors	(1, 0.875, 0.625)	(0,0,0)	(1, 0.875, 0.625)	(0.625, 0.375, 0.25)	(0.875, 0.75, 0.5)	(1, 0.875, 0.625)	(1, 0.875, 0.625)	(0.875, 0.625, 0.375)	(1, 0.875, 0.625)
Company Type	(0.875, 0.75, 0.5)	(0.875, 0.75, 0.5)	(0,0,0)	(0.5, 0.25, 0)	(0.25, 0, 0)	(0.75, 0.625, 0.375)	(1, 1, 0.75)	(1, 0.875, 0.625)	(0.75, 0.5, 0.25)
Infrastructure Factors	(0.25, 0, 0)	(0.5, 0.25, 0.125)	(0.375, 0.125, 0)	(0,0,0)	(0.5, 0.25, 0)	(1, 0.875, 0.625)	(1, 0.875, 0.625)	(1, 0.875, 0.625)	(1, 0.875, 0.625)
Managerial Factors	(1, 0.875, 0.625)	(1, 0.875, 0.625)	(1, 0.875, 0.625)	(0.75, 0.5, 0.25)	(0,0,0)	(0.75, 0.5, 0.25)	(0.625, 0.375, 0.25)	(1, 0.75, 0.5)	(0.75, 0.5, 0.25)
Institutional and Legal Factors	(1, 0.75, 0.5)	(1, 0.75, 0.5)	(0.75, 0.5, 0.25)	(0.875, 0.625, 0.375)	(0.625, 0.375, 0.125)	(0,0,0)	(1, 0.75, 0.5)	(0.875, 0.625, 0.375)	(1, 0.875, 0.625)
Supervisory and Technological Factors	(0.625, 0.375, 0.25)	(0.5, 0.25, 0)	(0.375, 0.125, 0)	(0.625, 0.375, 0.25)	(0.375, 0.125, 0)	(1, 0.75, 0.5)	(0,0,0)	(1, 0.75, 0.5)	(0.75, 0.625, 0.375)
Relationship Type	(0.75, 0.5, 0.25)	(0.375, 0.125, 0)	(0.5, 0.25, 0)	(1, 0.75, 0.5)	(0.625, 0.375, 0.125)	(0.5, 0.25, 0)	(1, 0.75, 0.5)	(0,0,0)	(1, 0.875, 0.625)
Investment Type	(0.625, 0.375, 0.125)	(0.75, 0.5, 0.25)	(0.875, 0.75, 0.5)	(1, 1, 0.75)	(1, 0.75, 0.5)	(1, 1, 0.75)	(1, 1, 0.75)	(1, 1, 0.75)	(0,0,0)

Step Two: Normalization of the Matrix

In this step, the matrix presented in Table 1 is normalized.
The normalized matrix is shown in Table 2.

Table 2. Normalized Matrix Using the Fuzzy DEMATEL Method

Normalized Matrix	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	(0,0,0)	(0.051, 0.017, 0)	(0.085, 0.051, 0.017)	(0.051, 0.017, 0)	(0.068, 0.034, 0)	(0.102, 0.068, 0.034)	(0.102, 0.085, 0.051)	(0.051, 0.017, 0)	(0.051, 0.017, 0)
Organizational Factors	(0.136, 0.119, 0.085)	(0,0,0)	(0.136, 0.119, 0.085)	(0.085, 0.051, 0.034)	(0.119, 0.102, 0.068)	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)	(0.119, 0.085, 0.051)	(0.136, 0.119, 0.058)
Company Type	(0.119, 0.102, 0.086)	(0.119, 0.102, 0.068)	(0,0,0)	(0.068, 0.034, 0)	(0.034, 0, 0)	(0.102, 0.085, 0.051)	(0.136, 0.136, 0.102)	(0.136, 0.119, 0.085)	(0.102, 0.068, 0.034)
Infrastructure Factors	(0.034, 0, 0)	(0.068, 0.034, 0.017)	(0.051, 0.017, 0)	(0,0,0)	(0.068, 0.034, 0)	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)
Managerial Factors	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)	(0.136, 0.119, 0.085)	(0.102, 0.068, 0.034)	(0,0,0)	(0.102, 0.068, 0.034)	(0.085, 0.051, 0.034)	(0.136, 0.102, 0.068)	(0.102, 0.068, 0.034)
Institutional and Legal Factors	(0.136, 0.102, 0.086)	(0.136, 0.102, 0.068)	(0.102, 0.068, 0.034)	(0.119, 0.085, 0.051)	(0.085, 0.051, 0.017)	(0,0,0)	(0.136, 0.102, 0.068)	(0.119, 0.085, 0.051)	(0.136, 0.119, 0.085)
Supervisory and Technological Factors	(0.085, 0.051, 0.034)	(0.068, 0.034, 0)	(0.051, 0.017, 0)	(0.085, 0.051, 0.034)	(0.051, 0.017, 0)	(0.136, 0.102, 0.068)	(0,0,0)	(0.136, 0.102, 0.068)	(0.102, 0.085, 0.051)

Relationship Type	(0.102, 0.068, 0.034)	(0.051, 0.017, 0)	(0.068, 0.034, 0)	(0.136, 0.102, 0.068)	(0.085, 0.051, 0.017)	(0.068, 0.034, 0)	(0.136, 0.102, 0.068)	(0,0,0)	(0.136, 0.119, 0.085)
Investment Type	(0.085, 0.051, 0.017)	(0.102, 0.068, 0.034)	(0.119, 0.102, 0.068)	(0.136, 0.136, 0.102)	(0.136, 0.102, 0.068)	(0.136, 0.136, 0.102)	(0.136, 0.136, 0.102)	(0.136, 0.136, 0.102)	(0,0,0)

Step Three: Matrix Separation

The first, second, and third elements in each matrix cell are separately extracted into individual tables. Following this, specific formulas are applied to calculate the outcomes, including:

- HL multiplied by (I - HL)^(-1)
- HM multiplied by (I - HM)^(-1)
- HU multiplied by (I - HU)^(-1)

Each step in the formulas is executed sequentially.

Initially, the identity matrix (denoted as I) is considered, represented as a 9 by 9 matrix where the diagonal elements are one, and all other elements are zero.

Step Four: Matrix Differentiation and Inversion

After establishing the identity matrix, the difference between the identity matrix and the matrices HL, HM, and HU is calculated. Subsequently, the inverse of these three matrices is determined.

Step Five: Matrix Multiplication

In this step, each of the matrices HL, HM, and HU is multiplied by the respective inverse matrices calculated in Step Four. The results are presented in tables belo.

Table 3. Multiplication of Matrix HL by its Inverse HL * (I - HL)^-1

Factors	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	0.0000	0.0000	0.0003	0.0000	0.0000	0.0014	0.0030	0.0000	0.0000
Organizational Factors	0.0102	0.0000	0.0092	0.0023	0.0056	0.0108	0.0120	0.0052	0.0107
Company Type	0.0062	0.0053	0.0000	0.0000	0.0000	0.0041	0.0140	0.0096	0.0023
Infrastructure Factors	0.0000	0.0005	0.0000	0.0000	0.0000	0.0095	0.0102	0.0099	0.0099
Managerial Factors	0.0096	0.0086	0.0088	0.0020	0.0000	0.0024	0.0028	0.0071	0.0024
Institutional and Legal Factors	0.0063	0.0056	0.0019	0.0040	0.0006	0.0000	0.0077	0.0046	0.0100
Supervisory and Technological Factors	0.0016	0.0000	0.0000	0.0018	0.0000	0.0058	0.0000	0.0060	0.0037
Relationship Type	0.0015	0.0000	0.0000	0.0058	0.0004	0.0000	0.0064	0.0000	0.0088
Investment Type	0.0010	0.0021	0.0061	0.0138	0.0055	0.0146	0.0161	0.0156	0.0000

Table 4. Multiplication of Matrix HM by its Inverse HM * (I - HM)^-1

Factors	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	0.0000	0.0011	0.0047	0.0011	0.0023	0.0088	0.0131	0.0015	0.0014
Organizational Factors	0.0303	0.0000	0.0277	0.0095	0.0193	0.0336	0.0369	0.0222	0.0331
Company Type	0.0207	0.0180	0.0000	0.0047	0.0000	0.0180	0.0380	0.0291	0.0134
Infrastructure Factors	0.0000	0.0039	0.0017	0.0000	0.0036	0.0278	0.0302	0.0290	0.0284

Managerial Factors	0.0281	0.0248	0.0257	0.0122	0.0000	0.0145	0.0115	0.0253	0.0144
Institutional and Legal Factors	0.0221	0.0196	0.0116	0.0169	0.0069	0.0000	0.0276	0.0202	0.0308
Supervisory and Technological Factors	0.0066	0.0033	0.0015	0.0068	0.0013	0.0197	0.0000	0.0203	0.0154
Relationship Type	0.0101	0.0015	0.0037	0.0190	0.0057	0.0051	0.0229	0.0000	0.0261
Investment Type	0.0100	0.0126	0.0221	0.0365	0.0196	0.0413	0.0453	0.0430	0.0000

Table 5. Multiplication of Matrix HU by its Inverse HU * (I - HU)^-1

Factors	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	0.0000	0.0167	0.0305	0.0179	0.0213	0.0447	0.0478	0.0210	0.0199
Organizational Factors	0.0896	0.0000	0.0819	0.0507	0.0638	0.0968	0.1040	0.0865	0.0955
Company Type	0.0650	0.0584	0.0000	0.0333	0.0132	0.0589	0.0885	0.0853	0.0582
Infrastructure Factors	0.0157	0.0300	0.0220	0.0000	0.0278	0.0805	0.0865	0.0841	0.0802
Managerial Factors	0.0849	0.0765	0.0778	0.0588	0.0000	0.0658	0.0581	0.0952	0.0651
Institutional and Legal Factors	0.0867	0.0783	0.0568	0.0722	0.0421	0.0000	0.1012	0.0840	0.0930
Supervisory and Technological Factors	0.0401	0.0279	0.0205	0.0394	0.0187	0.0754	0.0000	0.0784	0.0534
Relationship Type	0.0520	0.0214	0.0299	0.0721	0.0354	0.0362	0.0854	0.0000	0.0788
Investment Type	0.0518	0.0574	0.0692	0.0865	0.0742	0.0960	0.1033	0.1003	0.0000

Step Six: Integration of Matrices

At this stage, the three matrices corresponding to the first, second, and third elements are combined to form the final fuzzy matrix, as shown in Table 6.

Table 6. Final Fuzzy Matrix

Factors	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type
Individual Factors	(0, 0, 0)	(0.017, 0.001, 0)	(0.030, 0.005, 0)	(0.018, 0.001, 0)	(0.021, 0.002, 0)	(0.045, 0.009, 0.001)	(0.048, 0.013, 0.003)	(0.021, 0.001, 0)	(0.020, 0.001, 0)
Organizational Factors	(0.090, 0.030, 0.010)	(0, 0, 0)	(0.082, 0.028, 0.009)	(0.051, 0.009, 0.002)	(0.064, 0.019, 0.006)	(0.097, 0.034, 0.011)	(0.104, 0.037, 0.012)	(0.086, 0.022, 0.005)	(0.096, 0.033, 0.011)
Company Type	(0.065, 0.021, 0.006)	(0.058, 0.018, 0.005)	(0, 0, 0)	(0.033, 0.005, 0)	(0.013, 0, 0)	(0.059, 0.018, 0.004)	(0.088, 0.038, 0.014)	(0.085, 0.029, 0.010)	(0.058, 0.013, 0.002)
Infrastructure Factors	(0.016, 0, 0)	(0.030, 0.004, 0.001)	(0.002, 0.002, 0)	(0, 0, 0)	(0.028, 0.004, 0)	(0.081, 0.028, 0.010)	(0.086, 0.030, 0.010)	(0.084, 0.029, 0.010)	(0.080, 0.028, 0.010)

Managerial Factors	(0.085, 0.028, 0.010)	(0.077, 0.025, 0.009)	(0.078, 0.026, 0.009)	(0.059, 0.012, 0.002)	(0, 0, 0)	(0.066, 0.015, 0.002)	(0.058, 0.012, 0.003)	(0.095, 0.025, 0.007)	(0.065, 0.014, 0.002)
Institutional and Legal Factors	(0.087, 0.022, 0.006)	(0.078, 0.020, 0.006)	(0.057, 0.012, 0.002)	(0.072, 0.017, 0.004)	(0.042, 0.007, 0.001)	(0, 0, 0)	(0.101, 0.028, 0.008)	(0.084, 0.020, 0.005)	(0.093, 0.031, 0.010)
Supervisory and Technological Factors	(0.040, 0.007, 0.002)	(0.028, 0.003, 0)	(0.020, 0.001, 0)	(0.039, 0.007, 0.002)	(0.019, 0.001, 0)	(0.075, 0.020, 0.006)	(0, 0, 0)	(0.078, 0.020, 0.006)	(0.053, 0.015, 0.004)
Relationship Type	(0.052, 0.010, 0.002)	(0.021, 0.002, 0)	(0.030, 0.004, 0)	(0.072, 0.019, 0.006)	(0.035, 0.006, 0)	(0.036, 0.005, 0)	(0.085, 0.023, 0.006)	(0, 0, 0)	(0.079, 0.026, 0.009)
Investment Type	(0.081, 0.010, 0.001)	(0.057, 0.013, 0.002)	(0.069, 0.022, 0.006)	(0.086, 0.037, 0.014)	(0.074, 0.020, 0.005)	(0.096, 0.041, 0.015)	(0.103, 0.045, 0.016)	(0.100, 0.043, 0.016)	(0, 0, 0)

Step Seven: Defuzzification and Summation

In this step, the fuzzy matrix formed in the previous stage is defuzzified. Then, the row and column totals of the matrix are calculated, as shown in Table 7.

Table 7. Defuzzified Matrix

Factors	Individual Factors	Organizational Factors	Company Type	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Relationship Type	Investment Type	D (Row Sum)
Individual Factors	0.0000	0.0021	0.0045	0.0022	0.0029	0.0071	0.0085	0.0027	0.0025	0.0325
Organizational Factors	0.0178	0.0000	0.0163	0.0080	0.0120	0.0194	0.0211	0.0151	0.0192	0.1289
Company Type	0.0125	0.0111	0.0000	0.0047	0.0015	0.0110	0.0198	0.0170	0.0097	0.0874
Infrastructure Factors	0.0017	0.0043	0.0028	0.0000	0.0039	0.0162	0.0175	0.0169	0.0163	0.0796
Managerial Factors	0.0167	0.0150	0.0153	0.0095	0.0000	0.0108	0.0093	0.0170	0.0107	0.1043
Institutional and Legal Factors	0.0152	0.0137	0.0091	0.0122	0.0063	0.0000	0.0182	0.0143	0.0183	0.1074
Supervisory and Technological Factors	0.0061	0.0038	0.0026	0.0061	0.0024	0.0134	0.0000	0.0139	0.0098	0.0581
Relationship Type	0.0082	0.0027	0.0041	0.0129	0.0052	0.0052	0.0153	0.0000	0.0155	0.0692
Investment Type	0.0081	0.0094	0.0133	0.0192	0.0132	0.0215	0.0233	0.0224	0.0000	0.1304
R (Column Sum)	0.0864	0.0620	0.0680	0.0749	0.0473	0.1045	0.1331	0.1193	0.1020	

Step 8: In the next step, the sum and difference between the variables D and R are calculated, as shown in Table 8.

Table 8. Sum and Difference between the Row and Column Sums of the Defuzzified Fuzzy Matrix

	Individual Factors	Organizational Factors	Type of Company	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Type of Relationships	Type of Investment
D+R	0.1189	0.1909	0.1554	0.1544	0.1516	0.2119	0.1912	0.1885	0.2325
D-R	-0.0540	0.0669	0.0193	0.0047	0.0570	0.0028	-0.0750	-0.0501	0.0284

Finally, based on Table 8, the degree of influence and susceptibility of the nine research indices is determined. The effects of the indices are clearly visible in Figure 1.

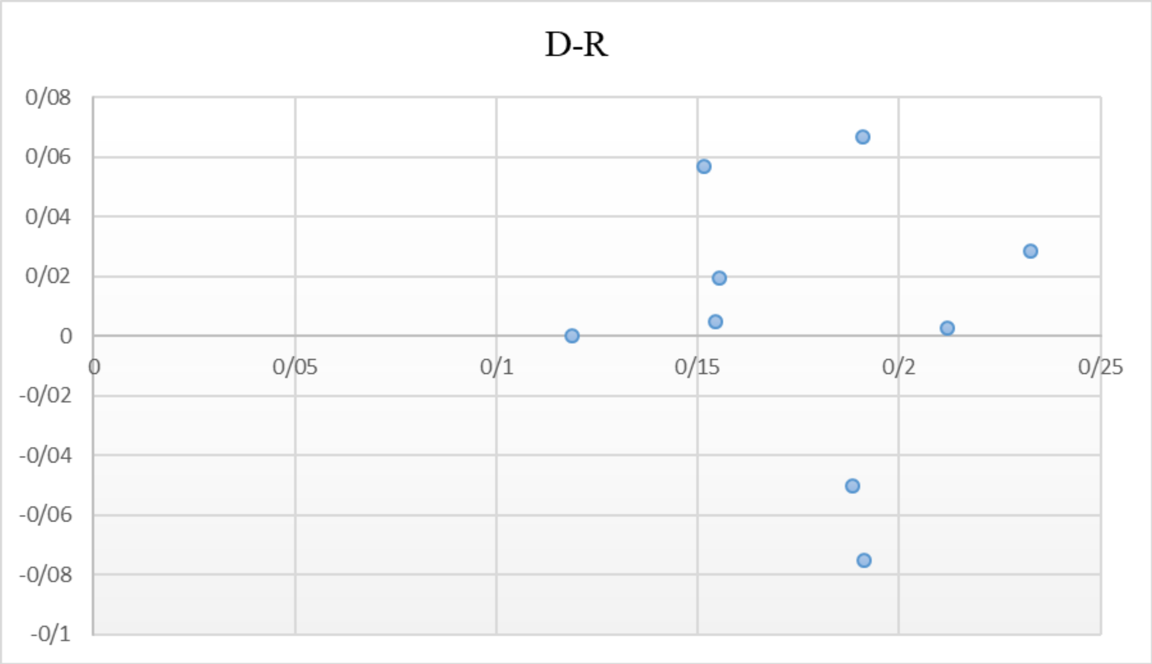

Figure 1. Influence and Susceptibility of Indices Affecting Audit Documentation Using Internet-Based Technologies

In Figure 1, as shown, the higher an index is along the y-axis, the greater its influence on audit documentation using internet-based technologies. Conversely, the lower an index is along the y-axis, the greater its susceptibility. According to Table 8 and Figure 1, the "Organizational Factors" index has the highest influence on audit documentation using internet-based technologies compared to the other indices, with the "Managerial Factors" index being the next in priority. Additionally, the susceptibility of the "Supervisory and Technological Factors" index is greater than that of the other indices.

Moreover, by calculating the threshold value of the defuzzified matrix, relationships between the indices can also be observed. Table 9 and Figure 2 illustrate the relationships among the indices.

Table 9. Relationships Among Indices Affecting Audit Documentation Using Internet-Based Technologies

Relationships Among Indices	Individual Factors	Organizational Factors	Type of Company	Infrastructure Factors	Managerial Factors	Institutional and Legal Factors	Supervisory and Technological Factors	Type of Relationships	Type of Investment
Individual Factors	0	0	0	0	0	0	0	0	0
Organizational Factors	1	0	1	0	1	1	1	1	1
Type of Company	1	1	0	0	0	1	1	1	0
Infrastructure Factors	0	0	0	0	0	1	1	1	1
Managerial Factors	1	1	1	0	0	1	0	1	1
Institutional and Legal Factors	1	1	0	1	0	0	1	1	1
Supervisory and	0	0	0	0	0	1	0	1	0

Technological Factors									
Type of Relationships	0	0	0	1	0	0	1	0	1
Type of Investment	0	0	1	1	1	1	1	1	0

Based on Table 10, the existence of a relationship between indices is indicated by the number 1, and the absence of a relationship is represented by the number 0.

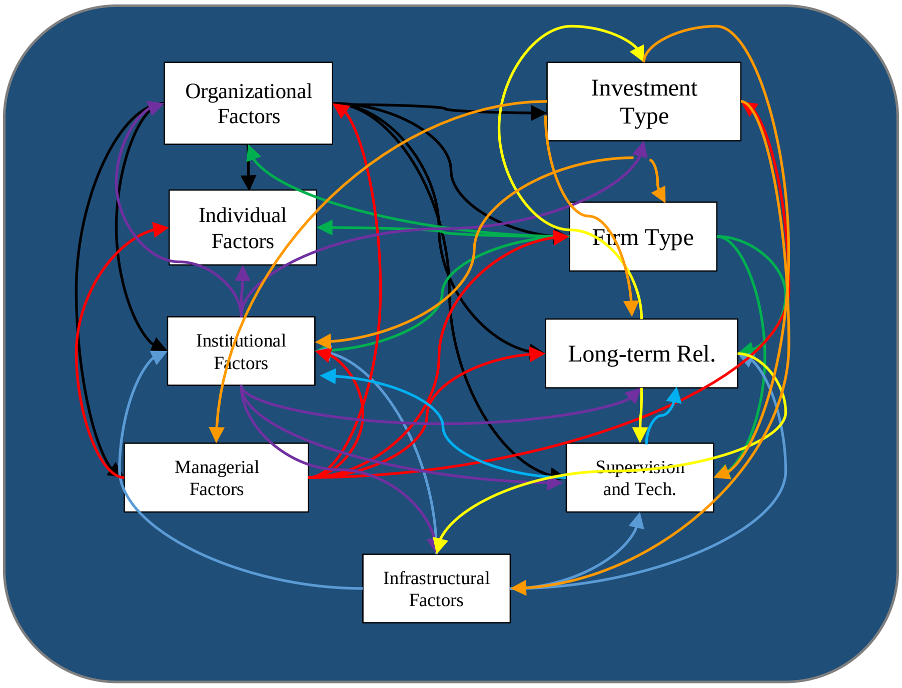

Figure 2. Relationships Among Indices in Audit Documentation Using Internet-Based Technologies

To determine the weight of importance of the indices in audit documentation using internet-based technologies, the fuzzy ANP method is used in this section. According to the literature and theoretical foundations referenced in previous sections, a total of nine indices have been identified and extracted. The symbol for each of these components is specified in Table 10 for easier identification in the analysis stages.

Table 10. Symbols Associated with the Research Indices

Index	Symbol
Individual Factors	F
Organizational Factors	S
Type of Company	H
Infrastructure Factors	Z
Managerial Factors	M
Institutional and Legal Factors	N
Supervisory and Technological Factors	T
Type of Relationships	R
Type of Investment	G

In the decision matrix formation phase, based on expert opinions, the decision matrix for the indices relative to the research goal is provided in Table 11.

Table 11. Decision Matrix of Indices Relative to the Goal

	F	S	H	Z	M	N	T	R	G
F	(1, 1, 1)	(0.143, 0.125, 0.111)	(3, 2, 1)	(4, 3, 2)	(0.333, 0.25, 0.2)	(1, 1, 1)	(0.333, 0.25, 0.2)	(0.2, 0.167, 0.143)	(0.25, 0.2, 0.167)
S	(9, 8, 7)	(1, 1, 1)	(9, 9, 9)	(9, 8, 7)	(3, 2, 1)	(8, 7, 6)	(7, 6, 5)	(1, 0.5, 0.333)	(9, 8, 7)
H	(1, 0.5, 0.333)	(0.111, 0.111, 0.111)	(1, 1, 1)	(4, 3, 2)	(1, 0.5, 0.333)	(4, 3, 2)	(3, 2, 1)	(0.2, 0.167, 0.143)	(0.25, 0.2, 0.167)
Z	(0.5, 0.333, 0.25)	(0.143, 0.125, 0.111)	(0.5, 0.333, 0.25)	(1, 1, 1)	(4, 3, 2)	(1, 1, 1)	(0.25, 0.2, 0.167)	(0.143, 0.125, 0.111)	(3, 2, 1)
M	(5, 4, 3)	(1, 0.5, 0.333)	(3, 2, 1)	(0.5, 0.333, 0.25)	(1, 1, 1)	(8, 7, 6)	(0.333, 0.25, 0.2)	(0.2, 0.167, 0.143)	(5, 4, 3)
N	(1, 1, 1)	(0.167, 0.143, 0.125)	(0.5, 0.333, 0.25)	(1, 1, 1)	(0.167, 0.143, 0.125)	(1, 1, 1)	(0.5, 0.333, 0.25)	(0.25, 0.2, 0.167)	(1, 0.5, 0.333)
T	(5, 4, 3)	(0.2, 0.167, 0.143)	(1, 0.5, 0.333)	(6, 5, 4)	(5, 4, 3)	(4, 3, 2)	(1, 1, 1)	(0.5, 0.333, 0.25)	(3, 2, 1)
R	(7, 6, 5)	(3, 2, 1)	(7, 6, 5)	(9, 8, 7)	(7, 6, 5)	(6, 5, 4)	(4, 3, 2)	(1, 1, 1)	(6, 5, 4)
G	(6, 5, 4)	(0.143, 0.125, 0.111)	(6, 5, 4)	(1, 0.5, 0.333)	(0.333, 0.25, 0.2)	(3, 2, 1)	(1, 0.5, 0.333)	(0.25, 0.2, 0.167)	(1, 1, 1)

Next Step: Calculating the Desirability Score

To calculate the desirability score, the first, second, and third elements of the above matrix are presented in Table 12.

Table 12. Matrix of Summed Elements of the Initial Decision Matrix

Symbol	First Element (I)	Second Element (m)	Third Element (u)
F	5.821	7.992	10.259
S	43.333	49.500	56.000
H	7.087	10.478	14.561
Z	5.889	8.116	10.536
M	14.926	19.250	24.033
N	4.250	4.652	5.584
T	14.726	20.000	25.700
R	34.000	42.000	50.000
G	11.144	14.575	18.726
Total	141.176	176.563	215.399

Table 13. Calculating Desirability (S)

Symbol	First Element (I)	Second Element (m)	Third Element (u)
F	0.027	0.045	0.073
S	0.201	0.280	0.397
H	0.033	0.059	0.103
Z	0.027	0.046	0.075
M	0.069	0.109	0.170
N	0.020	0.026	0.040
T	0.068	0.113	0.182
R	0.158	0.238	0.354
G	0.052	0.083	0.133

The degree of feasibility for each element is calculated using the following formula:

$$V(M_2 \geq M_1) = hgt(M_1 \cap M_2) = \mu_{M_2}(d) = \begin{cases} 1 & \text{if } m_2 \geq m_1 \\ 0 & \text{if } l_1 \geq u_2 \\ \dfrac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)} & \text{otherwise,} \end{cases}$$

If the second element of Criterion 2 is greater than the second element of Criterion 1, the result is 1.

If the first element of Criterion 1 is greater than the third element of Criterion 2, the result is 0.

Otherwise, the result is calculated using the third part of the formula.

The results of these calculations are presented in Table 14.

Table 14. Calculating the Degree of Feasibility for Each Criterion

	F	S	H	Z	M	N	T	R	G
F	1	1.000	1.000	1.000	1.000	0.398	1.000	1.000	1.000
S	0.000	1	0.000	0.000	0.000	0.000	0.000	0.783	0.000
H	0.739	1.000	1	0.757	1.000	0.168	1.000	1.000	1.000
Z	0.985	1.000	1.000	1	1.000	0.384	1.000	1.000	1.000
M	2.133	1.000	0.733	0.078	1	0.000	1.000	1.000	0.705
N	1.000	1.000	1.000	1.000	1.000	1	1.000	1.000	1.000
T	0.059	1.000	0.392	0.085	0.960	0.000	1	1.000	0.677
R	0.000	1.000	0.000	0.000	0.088	0.000	0.163	1	0.000
G	0.360	1.000	0.689	0.385	1.000	0.000	1.000	1.000	1

The minimum value of each column is determined, as shown in Table 15, and the weight of each criterion is calculated using the following formula:

$$d(A_i) = \frac{d'(A_i)}{\sum_{i=1}^{n} d'(A_i)};$$

$$W = (d(A_1), d(A_2), \ldots, d(A_n))^T$$

Table 15. Minimum Values of Each Column from the Decision Matrix

	F	S	H	Z	M	N	T	R	G
Min	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.783	0.000

Table 16. Calculated Weight for the Nine Research Indices

	F	S	H	Z	M	N	T	R	G
w	0	0.561	0.000	0.000	0.000	0.000	0.000	0.439	0.000

According to Table 16, the "Organizational Factors" index ranks first, followed by the "Long-Term Relationships" index in second place, with the remaining indices sharing the third priority.

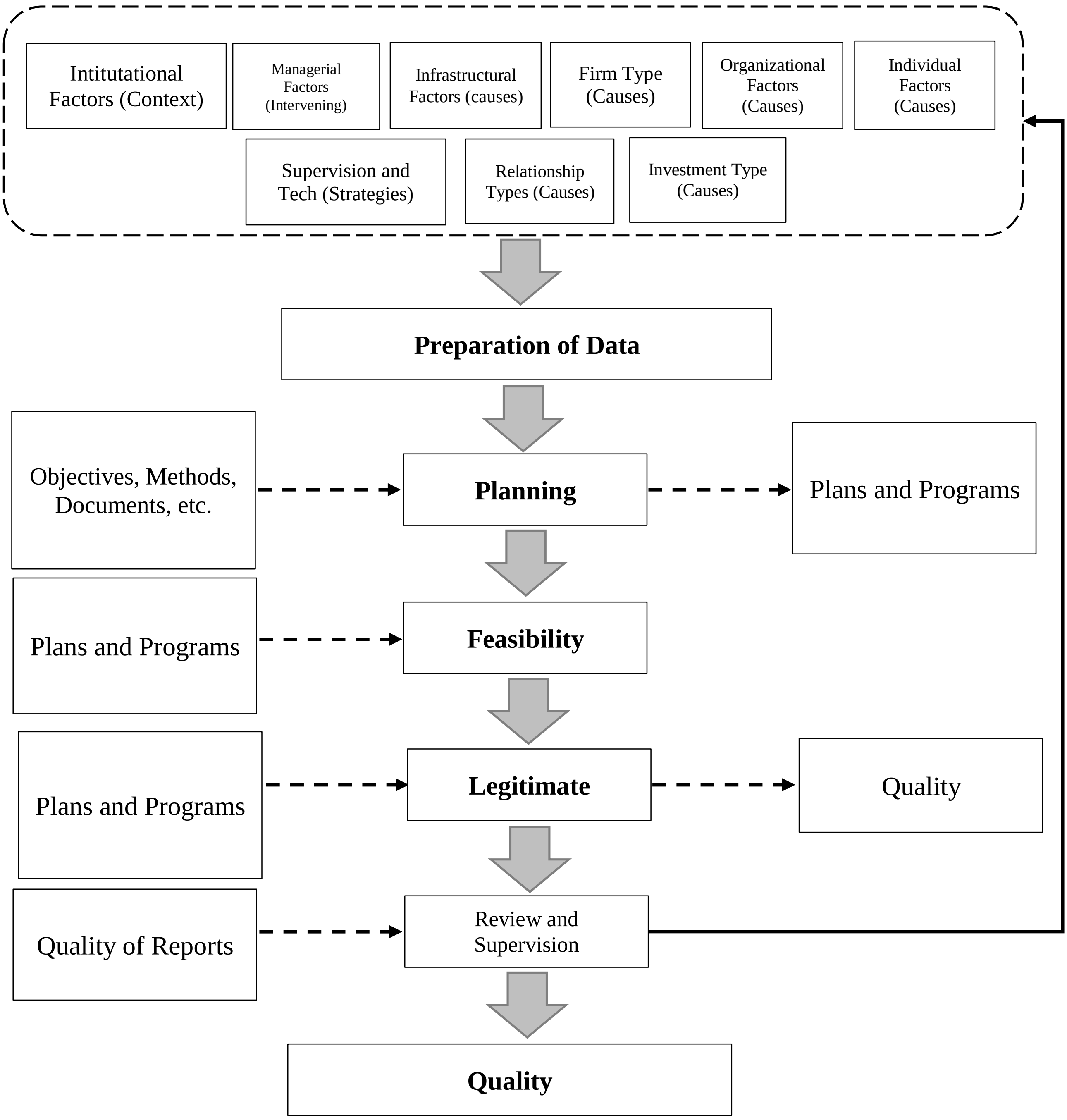

Figure 3. Model for Audit Documentation Quality Using Internet-Based Technologies

4. Discussion and Conclusion

Accountants and auditors will increasingly use sophisticated and intelligent technologies to enhance traditional work practices, and these technologies may even replace the traditional approaches. Intelligent software systems (including internet technology-based audit documentation services) support the outsourcing services trend, and the greater use of social media via intelligent technology enhances collaboration, disclosure, engagement with stakeholders, and broader communities. Social media platforms (including Facebook, Twitter, and Google search) provide more data than any corporate assurance report, and stakeholders use tools to interpret "big data."

This technology is not new for many sectors such as banking, automotive, retail, healthcare, education, and logistics. The quality of internet technology-based audit documentation services is also widely recognized as a key enabler for the manufacturing industry. This technology has the potential to transform traditional manufacturing models, assist in product innovation, and create effective factory networks with collaboration. The quality of different models for deploying internet technology-based audit documentation services facilitates the adoption for each of these sectors. By enhancing competitiveness through cost reduction, greater flexibility, scalability, and optimal resource utilization, this technology holds significant potential.

The nature of the impact of cloud computing technologies on auditing information systems is as follows:

The size of the company in terms of buildings and offices decreases because they allow assets to be managed from any location without commitment to a specific site. This is why they enable employees and stakeholders to access applications via computers and mobile devices from anywhere, provided there is internet access.

Operational performance improves in terms of facilitating the completion of operations in terms of processing, reporting, timeliness, and the accuracy of audit documentation quality in the auditing process. Internet technology-based audit documentation services represent a significant advancement in information technology and hold immense potential for delivering tangible business benefits to companies.

This study concluded that internet technology-based audit documentation services introduce new challenges and opportunities in many aspects of architecture, protocols, services, and internet applications. This technology affects many individuals within the organization and has a significant impact on investments and information technology costs. Additionally, this study identified security as the main barrier to broader cloud adoption. On the other hand, audit documentation and auditing services based on internet technology are also key targets for cyber attackers. These vulnerabilities highlight the importance of protecting cloud platforms, infrastructures, hosted applications, and data, and create a demand for higher-level cloud security management and centralized security management in cloud environments.

Other main concerns for IT managers include cloud compatibility with corporate policies, IS development environments, and business needs. If this technology is implemented correctly, there is real potential to enable accuracy, reliability, improved services, and cost reduction. The current challenge for IT experts is understanding the role of internet-based cloud technology-related audit documentation services and developing strategies that leverage its potential. They must fulfill prerequisites (the three stages of cloud service adoption strategy) before making the necessary technology decisions for successful audit strategies and cloud-based audit documentation services. Accountants and auditors should ensure internal controls to enhance reliability, accelerate agility, increase compliance, and improve data privacy.

On the other hand, cloud computing can be seen as a win-win strategy for both service providers and consumers, with the following benefits:

- **Meeting business needs:** Adjusting resource allocation on-demand to meet fluctuating customer needs.
- **Lower costs and energy savings:** Using low-cost computing, energy-efficient customer hardware, and server virtualization reduces both capital expenditure (CAPEX) and operational expenditure (OPEX).
- **Improved resource management efficiency through dynamic resource planning.** However, there are also significant challenges that need to be studied.
- **Privacy and security:** Customers are concerned about the privacy and security of their data compared to traditional hosting services.
- **Service continuity:** This refers to factors that may negatively impact cloud computing continuity, such as internet problems, power outages, service disruptions, and system failures.

Suggestions for Future Research on Internet Technology-Based Audit Documentation Quality

1. **Investigating the effects of internet-based technologies on audit quality:** This research could examine the impact of using software, online systems, blockchain, and artificial intelligence in improving audit quality and accuracy in documentation.
2. **Evaluating the opportunities and challenges in conducting audits using internet-based technologies:** Examining the opportunities and advantages of using internet-based technologies in the auditing process and identifying potential challenges and barriers could help improve strategies and methods for using these technologies.

3. **Exploring the role of training and awareness in improving audit documentation using internet-based technologies:** Researching the impact of training and raising awareness among employees and auditors on improving the efficiency and accuracy of audit documentation using new technologies could help optimize auditing activities.
4. **Evaluating security and privacy preservation in auditing activities using internet technologies:** Researching methods and standards for ensuring security and privacy preservation in auditing activities using internet-based technologies could contribute to ensuring the reliability of audit activities.
5. **Investigating the impact of legal changes and accounting systems on auditing activities using internet-based technologies:** Examining how legal changes and accounting systems can be adapted with the use of new technologies could help improve auditing activities and their documentation.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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