

Article type:
Original Research

Article history:
Received 12 May 2026
Revised 25 June 2026
Accepted 12 August 2026
Published online 01 September 2026

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How to cite this article:

Miarkiani, A., Alikhani, R., Maranjory, M., & Pourali,
M. R. (2026). Developing a Model of the Role of
Emerging Technologies in Transforming Auditors'
Roles and Improving Audit Functions. *Future of
Work and Digital Management Journal*, 4(6), 1-17.
<https://doi.org/10.61838/fwdmj.382>



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Developing a Model of the Role of Emerging Technologies in Transforming Auditors' Roles and Improving Audit Functions

ABSTRACT

The expansion of digital technologies and the increasing volume and complexity of financial data have transformed the manner in which audit evidence is collected and risks are assessed. Under these circumstances, understanding how emerging technologies are applied and their implications for the responsibilities, competencies, and structure of the auditing profession has become increasingly important. However, realizing the potential of these technologies in auditing depends on the availability of appropriate infrastructure, enhancement of auditors' professional competencies, and alignment of technological applications with the requirements of the audit process. The purpose of this study was to develop a model explaining the role of emerging technologies in transforming auditors' roles and improving audit functions in Iran. This applied study adopted a qualitative approach and employed thematic analysis. Data were collected through semi-structured interviews with 20 experts selected using purposive and snowball sampling techniques. Data analysis resulted in the identification of 82 initial codes and eight main themes. The themes comprised emerging technologies, efficiency of audit processes, effectiveness of audit processes, transformation of auditors' roles and skills, changes in audit firms' organizational structures, reduction of the audit expectation gap, reduction of the audit competitiveness gap, and sustainability and social responsibility. The findings demonstrate the potential of technology to facilitate continuous and data-driven auditing and to strengthen the analytical role of auditors. Realization of this potential depends on data quality, human oversight, skills development, organizational readiness, and technology governance. The resulting model can provide a framework for digital transformation planning in audit firms and for professional education and development.

Keywords: emerging technologies, auditor role, audit efficiency and effectiveness, audit expectation gap, audit competitiveness gap.

Introduction

The auditing profession is undergoing a fundamental transformation as organizations increasingly digitize financial reporting, internal control, risk management, and decision-making processes. The expansion of cloud-based infrastructures, artificial intelligence (AI), machine learning, robotic process automation, blockchain, advanced data analytics, and generative AI has altered both the volume and nature of information available to auditors and the technological architecture through which audit evidence is generated, processed, and evaluated. In traditional audit environments, professional work has largely depended on periodic examinations, sample-based testing, manual inspection of documents, retrospective risk assessment, and the auditor's direct interpretation of relatively structured accounting information. In contrast, contemporary digital environments provide auditors with access to large-scale, heterogeneous, real-time, and increasingly unstructured datasets, thereby creating opportunities for continuous monitoring, automated exception detection, predictive risk assessment, and more comprehensive analysis of transactions. Recent reviews of technology-enabled external auditing indicate that emerging

digital technologies are no longer peripheral tools supporting isolated audit procedures but are increasingly becoming integral components of the audit architecture itself, with important implications for audit planning, evidence collection, risk assessment, substantive testing, and reporting [1]. Similarly, the intellectual development of AI-enabled auditing has increasingly shifted the literature from questions concerning whether AI should be adopted toward more advanced questions about how AI adoption influences audit quality, professional judgment, institutional readiness, governance, and the redesign of audit processes [2]. This trajectory has been further accelerated by generative AI, which has expanded the range of tasks that may be technologically augmented, including document summarization, analytical review, anomaly interpretation, drafting, knowledge retrieval, and interaction with audit documentation [3].

The potential contribution of emerging technologies to auditing is particularly significant because audit effectiveness depends heavily on the quality, scope, timeliness, and interpretability of evidence. AI and advanced analytics can process large volumes of transactions more rapidly than traditional manual procedures and can identify patterns, associations, exceptions, and risk indicators that may be difficult to detect through conventional audit techniques. Evidence from recent studies suggests that AI adoption can improve financial reporting accuracy, increase auditing efficiency, and reduce information asymmetry when technological capabilities are supported by appropriate organizational structures, user acceptance, resource conditions, and data governance mechanisms [4]. AI applications may also reduce corporate audit risk by improving the identification of irregularities and strengthening auditors' ability to prioritize high-risk areas [5]. Empirical evidence from the Iranian auditing context likewise suggests that the use of AI can positively affect the quality of the financial statement audit process, reinforcing the relevance of technological adoption for the development of audit quality in emerging professional environments [6]. The feasibility of applying emerging AI technologies to improve auditing processes in Iran has also been examined, with findings emphasizing both the potential benefits of technological applications and the necessity of infrastructural, professional, and organizational readiness [7]. In this respect, the digital transformation of auditing should not be interpreted simply as the replacement of manual procedures with automated equivalents; rather, it represents a restructuring of how evidence is generated, how risks are evaluated, how exceptions are prioritized, and how auditors allocate their professional attention.

Among the principal technological developments reshaping audit work, AI has received particularly extensive attention because of its capacity to augment judgment-intensive and data-intensive activities. AI-assisted auditing can support auditors in identifying anomalous transactions, evaluating large datasets, recognizing hidden relationships, conducting text analysis, predicting financial distress, and developing real-time risk assessments. The concept of AI-copiloted auditing illustrates a model in which AI does not necessarily displace the auditor but operates as an analytical partner that extends human processing capacity while leaving higher-order evaluation and accountability with the professional auditor [8]. Field evidence, however, indicates that the opportunities associated with AI are accompanied by significant implementation challenges, including limited explainability, difficulties in integrating AI into established audit workflows, concerns regarding data quality, resistance to technological change, capability gaps, and uncertainty about responsibility for AI-assisted decisions [9]. The emergence of large language models has further intensified these concerns by introducing new possibilities for audit documentation, information retrieval, narrative analysis, and automated reasoning while simultaneously raising ethical questions related to confidentiality, bias, hallucination, transparency, data security, and accountability [10]. Consequently, the effectiveness of AI in auditing cannot be assessed solely on the basis of computational performance; it must also be

evaluated in relation to the professional, ethical, organizational, and governance structures within which auditors use technological outputs.

This issue is particularly important because auditing remains a profession grounded in professional judgment, professional skepticism, independence, and accountability. Although emerging technologies can increase the breadth and speed of audit analysis, excessive or uncritical reliance on automated outputs may weaken the auditor's independent assessment of evidence. Experimental research has shown that auditors' interaction with AI systems can influence the extent to which they rely on algorithmic recommendations, and that the manner in which auditors provide input into AI-supported processes may affect subsequent reliance on those systems [11]. This finding demonstrates that human–AI interaction is not merely a technical matter but also a behavioral and cognitive issue. The relationship between artificial intelligence and human intelligence therefore requires careful management so that technological assistance strengthens rather than substitutes professional skepticism and judgment [12]. Existing research on auditor behavior has already demonstrated that individual psychological biases and personality-related characteristics can influence audit quality, suggesting that technological transformation must be considered alongside the cognitive vulnerabilities and behavioral characteristics of auditors [13]. Accordingly, one of the most important consequences of emerging technologies is likely to be a redefinition of auditors' competencies. Auditors increasingly require combinations of accounting knowledge, audit expertise, data literacy, information systems understanding, algorithmic awareness, cybersecurity knowledge, programming capabilities, critical thinking, and the ability to evaluate the limitations of automated outputs.

The implications of emerging technologies also extend to the auditability of AI systems themselves. As client organizations increasingly embed AI in accounting systems, credit assessment, forecasting, internal controls, transaction processing, and decision-making, auditors must not only use AI but also develop the capacity to audit AI-enabled systems. This development creates a new professional frontier in which auditors must evaluate issues such as data lineage, model governance, training data quality, explainability, algorithmic bias, system security, output reliability, and control over automated decision-making. Recent research on AI auditability emphasizes that auditor readiness is becoming a critical precondition for the effective auditing of AI systems, because traditional audit competencies alone may be insufficient for evaluating complex algorithmic environments [14]. This challenge is closely related to broader developments in the technological structure of audit firms. The growing role of advanced technologies and automation is expected to influence staffing models, task allocation, training strategies, knowledge management, service design, and the hierarchical organization of audit firms [15]. Evidence concerning emerging digital technologies in audit firms similarly suggests that technological innovation generates substantial opportunities for efficiency and service improvement while simultaneously creating challenges related to investment costs, organizational adaptation, skills shortages, governance, and the redesign of professional work [16]. Thus, the transformation induced by emerging technologies is both technological and organizational, requiring changes in the structure, culture, and operating models of audit institutions.

Blockchain, distributed ledger technologies, cloud computing, digital assets, and other technology-enabled infrastructures further expand the scope of these transformations. Blockchain can potentially improve the traceability, immutability, and verifiability of transaction records, thereby changing the way auditors obtain and validate evidence. When combined with AI, blockchain may contribute to higher audit quality by strengthening the integrity of digital records and supporting more efficient verification processes [17]. However, the existence of tamper-resistant or automated records does not eliminate the

need for auditing; instead, it shifts audit attention toward system design, access controls, smart-contract logic, data governance, cybersecurity, and the reliability of inputs entering the technological system. Similarly, information and communication technologies can enhance auditing practices through improved data access, digital documentation, remote procedures, integrated communication, and analytical capabilities [18]. These developments support the gradual movement from periodic, backward-looking audits toward more continuous and forward-looking assurance models. Nevertheless, the transition depends on whether audit firms possess adequate technological infrastructure, interoperable systems, data standards, cybersecurity protections, and organizational capabilities to embed these tools into routine practice.

Beyond efficiency and audit quality, emerging technologies may also affect the broader social and institutional functions of auditing. The audit expectation gap—the difference between what stakeholders expect auditors to do and what auditing standards and professional practice actually require—has remained a persistent concern in the profession. A comprehensive bibliometric assessment indicates that the audit expectation gap continues to represent a significant and enduring topic in auditing research, reflecting unresolved tensions regarding auditor responsibilities, fraud detection, reporting, assurance, and public understanding of the audit function [19]. Research examining auditing standards also suggests that formal regulatory frameworks alone have not eliminated the expectation gap, implying that its persistence is rooted in broader structural and communicative dimensions of auditing [20]. Emerging technologies may help reduce certain dimensions of this gap by enabling more extensive transaction testing, faster detection of unusual patterns, improved transparency, and richer forms of assurance. At the same time, greater technological capability may generate new expectations that auditors should detect all fraud, continuously monitor all risks, or guarantee the accuracy of technologically generated information. This possibility indicates that technological advancement could both narrow and redefine the expectation gap, depending on how professional responsibilities and stakeholder expectations evolve.

The competitive implications of technological transformation are equally important. Audit firms that can successfully integrate AI, analytics, blockchain, cloud platforms, and automated workflows may be better positioned to provide faster, more differentiated, and higher-value services. Technology can create advantages in cost management, service scalability, risk assessment, client responsiveness, and the development of new advisory and assurance offerings. However, technologically advanced audit firms may also experience consequences that extend beyond the immediate benefits of improved capabilities. Research on enhanced audit-firm capabilities has identified possible spillover effects, indicating that the expansion of technological capacity can influence professional behavior, market positioning, and the broader nature of audit engagements in ways that may not always be intended [21]. The transformation of accounting and auditing therefore depends not only on technological investment but also on the institutional environment within which such investment occurs. In Iran, broader research on the development of accounting has shown that professional progress is shaped by interconnected institutional, educational, regulatory, organizational, and environmental factors rather than by isolated technical changes [22]. This perspective is particularly relevant to emerging technologies because successful digital transformation requires compatibility among technological infrastructure, professional standards, education, organizational readiness, and the regulatory environment.

Another increasingly important dimension concerns sustainability, social responsibility, and the expansion of assurance beyond traditional financial information. Organizations are under growing pressure to report environmental, social, governance, and other nonfinancial information, while stakeholders increasingly demand credible assurance regarding

sustainability performance, risk exposure, and corporate accountability. Emerging technologies can support this expansion by facilitating the integration and analysis of financial and nonfinancial datasets, enabling continuous monitoring of environmental indicators, tracing complex supply chains, and improving the auditability of sustainability-related information. At the same time, digitally enabled audit ecosystems introduce new social responsibilities related to cybersecurity, algorithmic fairness, transparency, privacy, data ownership, and responsible technological governance. Recent research on advanced and emerging technologies suggests that the future of auditing will increasingly depend on the profession's ability to integrate technological capability with ethical safeguards, professional judgment, and appropriate institutional controls [1, 15]. Moreover, the continued expansion of AI-enabled auditing requires a balance between automation and human oversight so that the efficiency gains of technology do not compromise accountability, skepticism, or audit quality [9, 12].

Taken together, the literature indicates that emerging technologies can influence auditing through several interconnected pathways: they can improve the efficiency of audit processes, enhance audit effectiveness, transform auditors' professional roles and competencies, alter the organizational structure of audit firms, affect the audit expectation gap, reshape the competitive positioning of audit providers, and expand the contribution of auditing to sustainability and social responsibility. However, these dimensions have frequently been investigated separately, with studies focusing on particular technologies, individual audit procedures, specific behavioral effects, or selected organizational consequences. The rapid development of generative AI and other advanced technologies further increases the need for integrated conceptual models capable of explaining how technological, human, organizational, professional, and societal dimensions interact within the auditing profession [3, 10]. This need is especially salient in Iran, where technological modernization of auditing must occur within specific institutional, regulatory, educational, infrastructural, and professional conditions and where the transfer of international models may not fully capture local implementation constraints and opportunities [6, 7, 22]. Therefore, a qualitative examination grounded in the experiences of auditing, information technology, academic, and managerial experts can contribute to a more comprehensive understanding of how emerging technologies are reshaping audit work and what conditions are necessary for their effective institutionalization.

Accordingly, the aim of this study is to develop a conceptual model explaining the role of emerging technologies in transforming auditors' roles and improving audit functions in Iran.

Methodology

The present study was applied in terms of purpose and qualitative in nature and was conducted using thematic analysis based on the approach proposed by Braun and Clarke (2006, 2021). This method is used to identify, analyze, and interpret patterns of meaning within qualitative data and enables researchers to extract major themes and explain the relationships among them based on participants' perspectives and experiences. The study participants consisted of experts in auditing and information technology, university faculty members, managers, and auditors with experience in emerging technologies during the 2026–2027 period. Interviewees were selected through purposive sampling supplemented by snowball sampling to ensure the inclusion of individuals possessing sufficient knowledge and experience regarding the research topic. Data were collected through semi-structured interviews and analyzed concurrently with the interview process. Data analysis followed Braun and Clarke's six-phase framework. First, the interview transcripts were read repeatedly to enable the researcher to develop an in-depth understanding of the data. Initial codes were then extracted from the interview transcripts and classified

into subthemes according to their conceptual similarities. Subsequently, related subthemes were organized into overarching themes and were refined through several rounds of review and comparison with the interview transcripts to ensure the internal coherence of each theme and its distinctiveness from other themes. Finally, the themes were defined and named, and the conceptual model of the study was developed accordingly. Sampling continued until newly collected data no longer generated additional codes, subthemes, or themes and information obtained from subsequent interviews merely confirmed the previous findings. This condition was observed after the sixteenth interview, such that no new concepts emerged from the final four interviews and these interviews merely enriched the existing data. Therefore, after 20 interviews had been conducted, data saturation and informational adequacy for answering the research questions were established, and the sampling process was terminated. To enhance the credibility of the findings, the preliminary results of the analysis were provided to several interviewees, and after receiving their corrective feedback, the final themes were reviewed and confirmed. Furthermore, the processes of data collection and analysis were fully documented, and the findings were reviewed by several experts in auditing and qualitative research methodology to enhance the dependability and robustness of the results. The demographic characteristics of the final 20 experts are presented in Table 1.

Table 1

Demographic Characteristics of the Participants

Characteristic	Category	Frequency	Percentage
Gender	Male	14	70
Gender	Female	6	30
Education	PhD	17	85
Education	Master's degree	3	15
Field of study	Accounting and Auditing	16	80
Field of study	Information Technology Management	2	10
Field of study	Other (Finance/Industrial Engineering)	2	10
Professional background	University professor and auditor	18	90
Professional background	Information technology manager and auditor	2	10
Professional experience	10–15 years	5	25
Professional experience	15–20 years	8	40
Professional experience	More than 20 years	7	35

According to Table 1, of the 20 participants, 70% were male and 30% were female. A total of 85% held doctoral degrees, while 80% had academic backgrounds in accounting and auditing. Eighteen participants (90%) simultaneously worked as university professors and auditors. All participants had more than 10 years of professional experience; 40% had between 15 and 20 years of experience, while 35% had more than 20 years of professional experience.

Findings and Results

The interview data were analyzed using thematic analysis in accordance with the approach proposed by Braun and Clarke (2006, 2021). Following complete transcription of the interviews, each transcript was read several times to enable the researcher to gain a comprehensive understanding of the data. Subsequently, statements and concepts relevant to the research objectives were identified and subjected to initial coding. At this stage, 82 initial codes were extracted from the complete set of interviews.

Table 2*Initial Codes Extracted From the Interviews*

No.	Identifier	Initial Code	Interview Numbers in Which the Code Was Extracted/Repeated
1	Code 01	Paradigm shift from traditional to digital auditing	1, 4, 7, 9, 12, 18
2	Code 02	Elimination of sampling and examination of 100% of transactions	2, 5, 8, 11, 14, 19
3	Code 03	Transformation of the auditor into a systems analyst	1, 3, 6, 10, 13, 15, 16
4	Code 04	Continuous monitoring	3, 5, 7, 12, 17, 20
5	Code 05	Reduction in physical and paper-based audit procedures	1, 2, 6, 9, 13, 15, 18
6	Code 06	Automated identification of exceptions	4, 8, 11, 14, 15, 16, 20
7	Code 07	Improved computational accuracy and reduction of human error	2, 5, 10, 13, 17, 19
8	Code 08	Increased reliability of interim reports	5, 9, 12, 16, 18, 20
9	Code 09	Need to revise national auditing standards	6, 8, 11, 13, 17, 19
10	Code 10	Role of technology in enhancing transparency in the financial supply chain	8, 10, 13, 15, 16, 18, 20
11	Code 11	Immutability of digital records	4, 7, 12, 16, 19
12	Code 12	Behavioral analytics	9, 11, 14, 15, 17, 18, 20
13	Code 13	Artificial intelligence in predicting going-concern status	7, 10, 12, 16, 19
14	Code 14	Necessity of learning programming languages such as Python	10, 13, 16, 18, 20
15	Code 15	Client data security challenges in audit firms	5, 8, 11, 14, 17, 19
16	Code 16	Integration of enterprise resource planning data with audit software	8, 11, 13, 17, 19
17	Code 17	Resistance of senior partners to technological change	9, 12, 14, 16, 18, 20
18	Code 18	High licensing costs of international software	11, 13, 17, 19
19	Code 19	Creation of competitive advantage for leading firms	10, 12, 16, 18, 20
20	Code 20	Changes in audit fees from hourly billing to value-added pricing	12, 14, 17, 19
21	Code 21	Auditing smart contracts	13, 16, 18, 20
22	Code 22	Tracking digital assets and cryptocurrencies	14, 17, 19
23	Code 23	Use of drones in inventory observation	14, 16, 20
24	Code 24	Remote auditing	9, 11, 13, 18, 20
25	Code 25	Social media analytics for reputational risk assessment	11, 13, 17, 19
26	Code 26	Need for auditors with dual-domain expertise	8, 10, 12, 16, 20
27	Code 27	Risk associated with algorithmic black boxes	10, 13, 17, 19
28	Code 28	Non-acceptance of digital evidence by judicial authorities	12, 16, 18, 20
29	Code 29	Impact of technology on reducing the public audit expectation gap	7, 10, 13, 17, 19
30	Code 30	Cloud computing for document sharing	13, 16, 18, 20
31	Code 31	Cybersecurity as a new audit domain	11, 14, 17, 19
32	Code 32	Automation of the confirmation process	9, 12, 16, 18, 20
33	Code 33	Text analytics in reports	13, 17, 19
34	Code 34	Identification of common beneficial owners in complex structures	14, 15, 16, 20
35	Code 35	Technology risk management in organizations	10, 12, 15, 17, 19
36	Code 36	Developing an organizational culture supportive of digital transparency	12, 16, 18, 20
37	Code 37	Impact of technology on the hierarchical structure of audit firms	11, 17, 19
38	Code 38	Development of real-time risk dashboards	13, 16, 18, 20
39	Code 39	Replacement of paper documents with digital tokens	14, 17, 19
40	Code 40	In-service training for experienced auditors	12, 16, 20
41	Code 41	Auditor independence in an environment of centralized systems	13, 15, 17, 19
42	Code 42	Data integrity challenges	14, 18, 20
43	Code 43	Standardization of data-exchange formats using Extensible Business Reporting Language (XBRL)	16, 19
44	Code 44	Reduction of travel costs associated with audit engagements	17, 20
45	Code 45	Role of technology in improving corporate governance	16, 18
46	Code 46	Identification of related-party transactions through graph analytics	17, 20
47	Code 47	Professional ethics in dealing with machine-based decision systems	15, 18, 19
48	Code 48	Real-time monitoring of liquidity and cash flows	16, 20
49	Code 49	Reduction of confirmation bias	17, 19
50	Code 50	Need to revise university curricula	16, 20
51	Code 51	Excessive reliance on system-generated outputs	15, 18, 19
52	Code 52	Creation of fully electronic audit files	17, 20
53	Code 53	Impact on the concept of materiality in the digital environment	15, 16, 18
54	Code 54	High-precision analysis of financial time series	19, 20
55	Code 55	Early detection of bankruptcy using data-driven models	15, 16, 18
56	Code 56	Tax-related challenges in the digital economy	17, 20

57	Code 57	Role of blockchain in verifying invoice authenticity	15, 18, 19
58	Code 58	Increased speed in responding to auditors' inquiries	16, 20
59	Code 59	Machine learning from system errors	15, 16, 20
60	Code 60	Change management in audit firms	17, 20
61	Code 61	Development of virtual internal controls	16, 18
62	Code 62	Strategies for migration to cloud-based systems	19, 20
63	Code 63	Integration of financial and nonfinancial data (environmental, social, and governance)	16, 18
64	Code 64	Intelligent compliance monitoring	14, 17, 20
65	Code 65	Reduction of tax fraud through bank transaction analytics	10, 18, 19
66	Code 66	Auditing environmental data	10, 16, 20
67	Code 67	Transparency in the audit-report preparation process	6, 17, 19
68	Code 68	Use of R for statistical analysis in auditing	5, 16, 20
69	Code 69	Validation protocols for artificial intelligence algorithms	8, 18, 19
70	Code 70	Proactive rather than retrospective monitoring	11, 17, 20
71	Code 71	Management of specialized technology talent	12, 16, 18
72	Code 72	Early-warning fraud detection systems	1, 19, 20
73	Code 73	Cyber-resilience standards	1, 16, 18
74	Code 74	Auditor's role in assuring the quality of input data	3, 17, 20
75	Code 75	Transparency in corporate disclosure of technology risks	2, 18, 19
76	Code 76	Risk modeling using deep learning	5, 16, 20
77	Code 77	Operational integration in outsourced auditing	4, 17, 19
78	Code 78	Changing role of the statutory auditor in examining systems	12, 16, 20
79	Code 79	Analysis of price trends and market anomalies	14, 18, 19
80	Code 80	Knowledge management and organizational memory within the audit system	5, 17, 20
81	Code 81	Enhancement of auditors' technological-emotional intelligence	17, 16, 18
82	Code 82	Sustainability of the audit ecosystem in the digital environment	9, 19, 20

Classification of the 82 initial codes resulted in the extraction of eight main themes. The main themes and their associated organizing themes are presented in Table 3.

Table 3

Main and Organizing Themes

No.	Main Themes	Organizing Themes
1	Emerging technologies	Digital transformation in auditing; artificial intelligence and data analytics; blockchain and digital assets; emerging operational technologies; cybersecurity and technology infrastructure
2	Efficiency of audit processes	Reduction of implementation costs and time; automation of audit operations; data integration and accessibility
3	Effectiveness of audit processes	Continuous and forward-looking monitoring; increased accuracy and reliability; fraud and risk detection; improvement in reporting quality
4	Transformation of auditors' roles and skills	Changes in auditors' professional roles; technological skills; continuous education and learning; cognitive and behavioral competencies
5	Changes in the organizational structure of audit firms	Organizational change management; knowledge and human capital management; transformation of organizational structure and operating model
6	Reduction of the audit expectation gap	Increased transparency and accountability; expansion of the scope of auditor responsibility
7	Reduction of the audit competitiveness gap	Technology-based competitive advantage; new value-creation models; stakeholder engagement and value
8	Sustainability and social responsibility	Sustainability; nonfinancial reporting and environmental, social, and governance auditing; social accountability; corporate governance and requirements of the digital environment

Analysis of the interview data demonstrated that **emerging technologies**, as one of the most important themes identified, play a foundational role in transforming the auditing profession. The findings indicated that, from the experts' perspective, technologies such as artificial intelligence, data analytics, blockchain, cloud computing, and intelligent systems are not merely tools for automating existing activities; rather, they are changing the nature of auditing, audit processes, and the professional roles performed by auditors. According to the interviewees, the development of emerging technologies has facilitated the transition from traditional auditing, characterized by periodic examinations, limited sampling, and an emphasis on historical information, toward intelligent, continuous, and data-driven auditing.

One interviewee stated in this regard:

“We are witnessing a transition from sample-based auditing toward continuous auditing. Technology allows us to access operational data at any point in time.”

Another expert similarly stated:

“The auditor’s role has shifted from that of an inspector to that of an analyst and risk advisor, and emerging technologies make it possible for decisions to be based on more precise analyses.”

Analysis of the interviews also indicated that **the efficiency of audit processes** constitutes one of the major consequences of the development of emerging technologies. The interviewees believed that technology enhances the productivity of audit processes by automating repetitive activities, reducing the time required to perform audit engagements, and optimizing resource utilization. In traditional environments, the large volume of documentation, time and cost constraints, and dependence on manual procedures represented major limitations in audit execution; however, technological tools have enabled rapid data processing, broader examination of information, and a reduction in manual activities.

One participant explained:

“Emerging technologies have reduced the time spent collecting audit evidence and have created greater opportunities for professional judgment and information analysis.”

In another dimension of the findings, **the effectiveness of audit processes** was identified as one of the main themes and consisted of four components: continuous and forward-looking monitoring, increased accuracy and reliability, fraud and risk detection, and improvement in reporting quality.

One interviewee stated:

“The future of auditing will increasingly move toward real-time monitoring; that is, rather than discovering a problem after the end of the year, the system should be capable of identifying risk indicators at the time they emerge.”

Another interviewee noted:

“Artificial intelligence can identify patterns in data that may not be observable through conventional audit procedures; however, the final decision still requires the auditor’s professional judgment.”

One interviewee further stated:

“In the past, auditors primarily searched for obvious indicators of fraud, whereas today, data analytics can be used to identify hidden risk signals before a problem actually occurs.”

One expert explained:

“Technology has transformed the auditor’s report from a traditional report that merely communicates the results of audit procedures into a more analytical report that provides additional information about organizational risks and conditions.”

Table 4 presents the final structure of the themes, their constituent components, and the conceptual position of each theme within the research model.

Table 4

Final Structure of the Themes and Subthemes

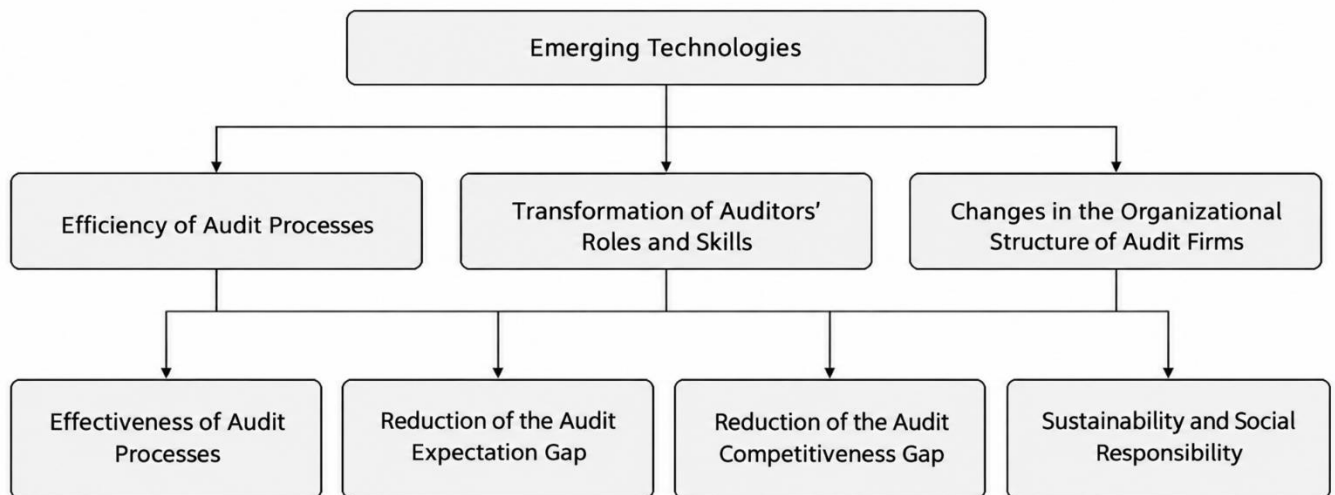
Main Theme	Subthemes/Components	Conceptual Position in the Research Model
Emerging technologies	Digital transformation in auditing; artificial intelligence and data analytics; blockchain and digital assets; emerging operational technologies; cybersecurity and technology infrastructure	Driving factor and primary platform for digital transformation in the auditing profession
Efficiency of audit processes	Reduction of implementation costs and time; automation of audit operations; data integration and accessibility	Direct operational outcome of emerging technologies and an indicator of increased audit productivity

Effectiveness of audit processes	Continuous and forward-looking monitoring; increased accuracy and reliability; fraud and risk detection; improvement in reporting quality	Direct qualitative outcome of technology and an indicator of improved audit service quality
Transformation of auditors' roles and skills	Changes in auditors' professional roles; technological skills; continuous education and learning; cognitive and behavioral competencies	Human mechanism underlying transformation and a key success factor in effective technology utilization
Changes in the organizational structure of audit firms	Organizational change management; knowledge and human capital management; transformation of organizational structure and operating model	Organizational mechanism required for the adoption and institutionalization of technology
Reduction of the audit expectation gap	Increased transparency and accountability; expansion of the scope of auditor responsibility	Social consequence of technological transformation and enhanced stakeholder trust
Reduction of the audit competitiveness gap	Technology-based competitive advantage; new value-creation models; stakeholder interaction and value creation	Strategic consequence of technology and increased competitive capability of audit firms
Sustainability and social responsibility	Nonfinancial reporting and sustainability auditing; social accountability; corporate governance; requirements of the digital environment	Extended consequence of technological transformation toward a more socially responsible and sustainable role for auditing

Figure 1 illustrates the conceptual relationships derived from the interpretation of the interviews. These relationships represent a qualitative explanation of the findings and should not be interpreted as evidence of statistically tested causal relationships.

Figure 1

Model of the Role of Emerging Technologies in Transforming Auditors' Roles and Improving Audit Functions



Discussion and Conclusion

The present study developed a qualitative model explaining the role of emerging technologies in transforming auditors' roles and improving audit functions in Iran. The thematic analysis resulted in eight main themes: emerging technologies, efficiency of audit processes, effectiveness of audit processes, transformation of auditors' roles and skills, changes in the organizational structure of audit firms, reduction of the audit expectation gap, reduction of the audit competitiveness gap, and sustainability and social responsibility. Taken together, these findings indicate that emerging technologies should not be regarded merely as supplementary technical tools added to conventional audit procedures. Rather, they constitute a structural force capable of reshaping the logic of audit work, redefining the auditor's professional role, altering audit-firm operating models, and expanding the social and strategic functions of auditing. This interpretation is consistent with recent literature describing digital technologies as a major driver of transformation across evidence collection, risk assessment, continuous monitoring, professional judgment, and reporting [1, 2]. The present findings also support the view that the

development of AI, data analytics, blockchain, cloud computing, and other emerging technologies is creating a transition from periodic and historically oriented auditing toward more continuous, predictive, and data-intensive forms of assurance [15, 16].

The first major finding concerned the foundational role of emerging technologies themselves. Participants emphasized artificial intelligence, data analytics, blockchain, cloud-based systems, digital assets, cybersecurity technologies, and other advanced operational tools as the technological basis of contemporary audit transformation. Their accounts suggested that these technologies enable broader data access, automated transaction analysis, real-time monitoring, digital evidence processing, and new mechanisms for verifying financial information. This finding corresponds closely with the systematic review by Abderrahman and Makarem, who identified emerging technologies as central to the changing structure of external audit practices and highlighted their implications for evidence collection, audit planning, and professional responsibilities [1]. It is also consistent with the intellectual mapping conducted by Sundarasan et al., which showed that research on AI-enabled auditing has increasingly progressed from basic adoption questions toward issues of audit quality, governance, organizational integration, and professional transformation [2]. Similarly, Zhang and Zhou argued that generative AI is likely to reshape a wide range of audit activities, including document analysis, knowledge retrieval, communication, and analytical support, while simultaneously creating new questions concerning reliability and professional accountability [3]. Therefore, the current findings reinforce the proposition that technological transformation in auditing is systemic rather than incremental.

The second major finding was that emerging technologies improve the efficiency of audit processes by reducing the time and cost of engagements, automating repetitive tasks, improving access to data, and decreasing dependence on manual and paper-based procedures. Interviewees specifically referred to automated confirmations, electronic audit files, remote auditing, reduced travel costs, data integration, and rapid processing of large transaction volumes. These results are consistent with research indicating that AI adoption can improve auditing efficiency by automating routine procedures and enabling more efficient processing of financial information [4]. Thottoli likewise found that the integration of information and communication technology and AI can enhance audit practice through improved data access, faster processing, digital communication, and automation of conventional audit procedures [18]. The evidence is also consistent with Iranian research showing that the application of AI can improve the quality and efficiency of financial statement auditing when adequate technological and organizational conditions are available [6, 7]. Importantly, the present study suggests that efficiency is not limited to reducing labor hours. Technology also reallocates auditors' time away from repetitive verification activities toward interpretation, professional judgment, and higher-value analytical tasks.

A closely related finding concerned the effectiveness of audit processes. Participants associated emerging technologies with continuous and forward-looking monitoring, greater accuracy and reliability, stronger fraud and risk detection, and improved quality of reporting. These findings indicate that technological transformation affects not only how quickly audit procedures are performed but also the informational quality of audit work. AI-based analytics can identify unusual transactions, behavioral patterns, latent risk indicators, and complex relationships that may be difficult to detect through conventional examination. This finding is consistent with Li's evidence that AI can reduce corporate audit risk by strengthening auditors' ability to identify and respond to risk-relevant information [5]. It also aligns with Qader and Cek, who found that AI and blockchain can contribute positively to audit quality by improving the integrity, accessibility, and analytical processing of audit evidence [17]. The present study's emphasis on real-time risk dashboards, early-warning fraud systems, and predictive

analysis is additionally compatible with the AI-copiloted auditing framework, in which intelligent systems support auditors by identifying anomalous patterns and prioritizing areas requiring professional investigation [8]. Thus, the findings suggest that technology may move auditing from a predominantly retrospective control function toward a more preventive and anticipatory assurance function.

However, the findings also demonstrated that technological effectiveness remains dependent on human oversight and professional judgment. Participants explicitly referred to the risks of algorithmic black boxes, overreliance on system outputs, data-integrity problems, and the need for protocols to validate AI algorithms. This is an important result because it challenges technologically deterministic interpretations according to which greater automation necessarily generates better audit outcomes. Commerford et al. showed that auditors' interaction with AI can influence their reliance on algorithmic recommendations and that the structure of human involvement affects how auditors interpret and use AI-generated outputs [11]. Deliu similarly emphasized that professional skepticism and judgment remain indispensable in environments where artificial and human intelligence interact [12]. The current findings therefore indicate that effective technological adoption requires an appropriate balance between automation and auditor intervention. AI may expand the auditor's informational and analytical capacity, but the evaluation of evidence, interpretation of uncertainty, assessment of materiality, and final professional conclusion remain fundamentally dependent on qualified human judgment.

Another central finding concerned the transformation of auditors' roles and skills. Participants described a shift from the auditor as a traditional inspector toward roles such as systems analyst, risk advisor, data analyst, technology evaluator, and assurance provider. They also emphasized the need for programming skills, data-analysis capabilities, cybersecurity knowledge, continuing professional education, and new cognitive and behavioral competencies. This transformation is strongly supported by previous studies. Lombardi et al. reported that increased automation and advanced technologies are expected to alter the allocation of audit tasks, skill requirements, staffing models, and the nature of professional work [15]. Li and Goel further demonstrated that auditor readiness has become particularly important as auditors are increasingly required not only to use AI but also to assess the auditability of AI-enabled systems [14]. The findings of Kokina et al. similarly suggest that one of the major barriers to effective AI adoption in auditing is the shortage of professionals who combine accounting expertise with sufficient technological competence [9]. The present findings therefore support the development of a dual-competency model in which auditors need both strong professional accounting knowledge and digital capabilities.

The importance of cognitive and behavioral competencies identified in this study is also noteworthy. Participants referred to professional ethics, technological-emotional intelligence, reduced confirmation bias, and the need to retain professional skepticism despite greater reliance on automated systems. These findings are consistent with prior Iranian research showing that individual psychological biases and personality dimensions can significantly affect audit quality [13]. The introduction of AI does not eliminate these behavioral influences; rather, it may create new forms of cognitive risk, including automation bias, excessive trust in algorithmic outputs, or reluctance to challenge technologically generated recommendations. This interpretation is supported by Commerford et al.'s evidence concerning auditors' reliance on AI [11]. Accordingly, technological competence should not be interpreted narrowly as the ability to operate software or analyze data. It should also include the capacity to critically evaluate system outputs, recognize algorithmic limitations, preserve independence, and exercise professional skepticism in technologically mediated environments.

The findings further showed that the adoption of emerging technologies requires substantial changes in the organizational structure of audit firms. Participants referred to resistance among senior partners, the need for change management, knowledge management, specialized technological talent, cloud migration strategies, and changes in hierarchical structures and operating models. These findings closely correspond with Vitali and Giuliani, who found that emerging digital technologies create both significant opportunities and organizational challenges for audit firms, including investment requirements, integration difficulties, capability gaps, and structural adaptation [16]. Lombardi et al. similarly showed that advanced technology and automation are likely to transform staffing patterns, work allocation, and firm-level operating structures [15]. The present study extends these arguments by highlighting that technological adoption requires institutionalization rather than isolated acquisition of software. Audit firms must develop internal governance structures, cultivate technological leadership, revise training systems, retain specialized personnel, and integrate technological knowledge into organizational memory. This result is particularly relevant in the Iranian context, where broader accounting development has been shown to depend on interconnected institutional, educational, professional, and organizational conditions [22].

Another important finding concerned the potential of technology to reduce the audit expectation gap. Participants associated technological adoption with greater transparency, improved responsiveness, wider audit coverage, and an expanded scope of auditor responsibility. These developments may help narrow some dimensions of the expectation gap because stakeholders may receive more timely information and auditors may gain stronger capabilities to detect unusual patterns and evaluate larger proportions of transactions. This finding is broadly consistent with the literature describing the expectation gap as a persistent structural problem concerning the difference between public expectations and auditors' actual responsibilities [19]. Jedidi and Humphrey further demonstrated that the expectation gap persists even in mature regulatory environments and cannot be resolved solely through formal auditing standards [20]. The present study suggests that technology may contribute to reducing this gap by improving transparency and audit capability, but it may simultaneously create new expectations. As technological capacity increases, stakeholders may assume that auditors should identify every instance of fraud, continuously monitor all transactions, or provide real-time assurance. Therefore, technological development may transform the nature of the expectation gap rather than eliminate it completely.

The theme of reducing the audit competitiveness gap also emerged from the data. Participants indicated that technologically advanced audit firms may develop competitive advantages through improved service quality, faster response times, new value-creation models, enhanced stakeholder interaction, and reduced operating costs. This finding supports the argument that advanced technological capability can become a strategic resource for audit firms rather than merely an operational tool. Cheng et al. showed that enhanced audit-firm capabilities can generate wider consequences for firm behavior and market positioning, including unintended spillover effects [21]. Bin-Nashwan et al. likewise emphasized that successful AI adoption is closely linked to organizational resources, technological readiness, and governance conditions [4]. The findings of the present study indicate that audit firms that are able to integrate technology more effectively may differentiate themselves in terms of quality, speed, analytical sophistication, and stakeholder value. At the same time, unequal access to technological resources may widen competitive disparities between large and small audit firms, making technological readiness an increasingly significant determinant of market position.

The final major theme concerned sustainability and social responsibility. Participants identified the integration of financial and nonfinancial information, environmental data auditing, ESG-related assurance, corporate governance, digital accountability, and the sustainability of the audit ecosystem as increasingly important consequences of technological transformation. This finding reflects the expanding boundaries of auditing beyond traditional financial statement assurance. Advanced technologies can facilitate the collection and analysis of heterogeneous sustainability information and can support more continuous monitoring of environmental, social, and governance indicators. At the same time, digital transformation creates new responsibilities concerning cybersecurity, algorithmic accountability, data quality, transparency, and responsible technology governance. The ethical concerns associated with large language models and AI-assisted auditing identified by Fotoh and Mugwira are particularly relevant in this respect, as they highlight risks related to confidentiality, bias, transparency, and accountability [10]. More broadly, the current findings are consistent with the view that the future of auditing depends on the integration of technological capability with human judgment, ethical safeguards, governance, and broader stakeholder accountability [1, 3].

Overall, the findings support an integrated interpretation of digital transformation in auditing. Emerging technologies function as the primary driver of change, but their consequences are mediated through human competencies and organizational structures. They directly influence audit efficiency and effectiveness while indirectly reshaping stakeholder expectations, competitive dynamics, sustainability responsibilities, and the broader social role of auditing. This integrated structure helps explain why technological investment alone is insufficient to guarantee successful transformation. The benefits identified in previous research—including higher efficiency, improved risk detection, stronger audit quality, and enhanced analytical capacity—can only be realized when organizations simultaneously address data quality, professional readiness, ethical governance, cybersecurity, organizational resistance, and human oversight [9, 14, 16]. In this sense, the conceptual model developed in the present study provides a multidimensional explanation of how emerging technologies can reshape auditing in Iran and highlights that digital transformation is simultaneously a technological, professional, organizational, competitive, and societal process.

The present study is subject to several limitations. First, the research adopted a qualitative design and relied on semi-structured interviews with 20 experts; therefore, the findings reflect expert interpretations and cannot be statistically generalized to the entire population of auditors or audit firms. Second, although data saturation was achieved, the participants were selected purposively and through snowball sampling, which may have increased the representation of individuals with greater interest in technological developments. Third, the study was conducted within the Iranian professional and institutional environment, and some identified barriers and opportunities may be influenced by local regulatory, technological, educational, and economic conditions. Fourth, the rapid pace of technological development means that the relative importance of specific technologies may change over time. Finally, the conceptual relationships presented in the proposed model are qualitative and interpretive and were not tested statistically for direction, magnitude, mediation, or causality.

Future research should empirically validate the proposed model using large-scale quantitative studies involving auditors from different types and sizes of audit firms. Structural equation modeling could be employed to test the relationships among technological adoption, auditor competencies, organizational readiness, audit efficiency, audit effectiveness, expectation-gap reduction, competitive advantage, and sustainability outcomes. Longitudinal studies would also be valuable for

examining how audit practices and professional roles change as technologies become more mature and widely institutionalized. Comparative studies across countries could determine whether the relationships identified in this study vary according to regulatory systems, levels of digital infrastructure, or professional development. Future research may also investigate specific technologies separately, including generative AI, blockchain, robotic process automation, cloud auditing, and deep-learning systems. Experimental studies could further examine automation bias, professional skepticism, algorithmic reliance, explainability, and human–AI collaboration in audit decision-making.

From a practical perspective, audit firms should adopt emerging technologies through a coordinated digital-transformation strategy rather than through fragmented acquisition of individual technological tools. Investment in technological infrastructure should be accompanied by systematic development of auditors' competencies in data analytics, programming, cybersecurity, AI governance, and evaluation of automated outputs. Firms should establish clear governance frameworks for validating algorithms, protecting client data, documenting human oversight, and maintaining auditor independence. Professional associations and universities should revise education and continuing professional development programs to incorporate interdisciplinary knowledge from accounting, information systems, data science, and technology risk management. Audit firms should also redesign workflows and organizational structures to support collaboration between auditors and technology specialists, while preserving professional judgment as the final basis for assurance decisions. In addition, regulators should facilitate the legal recognition of digital evidence, modernization of auditing standards, and development of guidance for AI-assisted and continuous auditing so that technological innovation can be implemented consistently, responsibly, and effectively.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

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