Enhancing Emerging Technologies to Improve the Quality of Accounting Information Systems: A Review

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Abstract

In the current era of the sharing economy, emerging technologies, such as blockchain, artificial intelligence, cloud computing, big data, and the Internet of Things have been widely used in the field of accounting. This is promoting the new development of accounting information systems. The study examined and analyzed three key aspects: fundamental quality characteristics, enhanced quality characteristics, and cost-benefit restrictions. The integration of emerging technologies and accounting has yielded noteworthy outcomes. It has come to light that this synergy empowers accounting information not only to accurately reflect reality but also to sustain its relevance, thereby achieving a harmonious balance between these two fundamental quality characteristics. This study holds substantial significance for the progression of accounting theory within the realm of emerging technologies.

Keywords: *Emerging technologies; accounting information quality; blockchain; AI (artificial intelligence)*

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1. Introduction

Presently, human development has entered the new era of Industry 4.0. This has led to a fundamental shift in the constraints of human social development owing to the progress and application of emerging technologies such as blockchain, artificial intelligence, big data, cloud computing, and the Internet of Things (IoT); these provide the basis for a new way of value creation (Aoun et al., 2021). Based on the theory of imitators' dynamic capacities, the burgeoning study of emerging technologies offers ample opportunities for theoretical and practical innovation within the field of accounting (Chowdhury & Quaddus, 2017). Artificial intelligence, electronic invoicing, digitalization of economic operations, and the use of blockchain technologies are fostering trust among participants and enabling fair competition on a level playing field. The continuous advancement and integration of emerging technologies with other information technologies contribute to the enrichment and virtualization of accounting methods. This leads to the creation of novel accounting processing flows, triggering new demands for the quality characteristics of accounting information from all users of such information (Han et al., 2023). The integration of emerging technologies and accounting is presenting the features of open sharing, the interconnection of everything, structural reshaping and innovation orientation (Mubarak & Petraite, 2020). These emerging technologies are leveraging a wide range of data sources and advanced data collection, processing, analysis, and application technologies as they continuously transform the generation, dissemination, reporting, application, and management methods of accounting information. Thus, this comprehensively improves the quality characteristics of accounting information (Xu, 2015).

According to Kuznets' "modern growth theory", emerging technological advances and the corresponding management system innovation are the keys to the sustainable growth of the country's overall economy (Kuznets, 1973). Accounting information plays a vital part in the contemporary information society, serving as a significant provider of information resources within a modern information system. The quality of accounting information is a crucial factor in business management. The level of control over the quality of accounting information directly impacts an enterprise's ability to make scientific decisions regarding business management benefits and core competitiveness. Furthermore, it significantly influences the prospects for enterprise development (Latifah et al., 2021). Emerging technologies have led to a diversification and personalization of accounting information in financial presentations. The development of intelligent accounting business processing has become an unavoidable trend (Gotthardt et al., 2020). The use of a comprehensive intelligent management mode can increase the efficiency of enterprise employees to process information and save time (Dai & Vasarhelyi, 2023). Furthermore, the integration of work via the Internet of Things (IoT) not only diversifies the presentation format of financial reports, but it also enhances the timeliness of information. This facilitates the timely and accurate acquisition of pertinent accounting information by information users (Lv & Li, 2021).

The application of emerging technologies such as blockchain, artificial intelligence, big data, cloud computing, and the Internet of Things in the domain of accounting is anticipated to surpass the limitations of cost-benefit in the existing system of the quality attributes of accounting information.

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This is expected to enhance the promptness, comparability, comprehensibility, and verifiability of accounting information (Abdelraheem et al., 2021). At the same time, the combination of emerging technologies and accounting enables accounting information to simultaneously satisfy the two key quality characteristics of truthfulness and relevance (Wu, Xiong, & Li, 2019). The application of emerging technologies can efficiently integrate data with diverse economic characteristics into an accounting information system, hence enhancing the information's relevance. Furthermore, automated information processing and intelligent decision support provide strong support to ensure the authenticity of accounting information (Guo, Wang, Xu, & Wu, 2020).

The use of emerging technologies in the fields of accounting and accounting information quality holds significant inventive value. This use is expected to result in a surge in practical application and a corresponding increase in research interest, both presently and in the future (Chiu, Liu, Muehlmann, & Baldwin, 2019). Nevertheless, the existing study regarding the influence of emerging technologies on the quality of accounting information remains insufficient. The majority of academics talk about the effects of a certain quality attribute of accounting information from a single technological standpoint. This paper searches the literature on related topics through the Web of Science database to analyze the trend of temporal and spatial evolution of related literature. Additionally, this literature review also summarizes and organizes the literature in detail, according to the research content, as a way to further deepen research on the theme.

The research contribution of this paper is mainly reflected in two aspects. First, it enriches the theoretical research on the characteristics of accounting information quality. This study mainly discusses some new developments in the meaning of accounting information quality characteristics under "emerging technology + accounting", which enriches the research system of accounting information quality characteristics. Second, it enriches the theory of technological innovation. Emerging technologies are part of the accounting development environment, and the accounting application of emerging technologies has given new connotations to scientific and technological innovation in micro-management, in macroeconomics, and in the fulfillment of social responsibilities.

This paper of the study has eight sections. The second section is the research method. This part summarizes the related theme literature and offers an explanation of the potential research prospects. The third section is an overview of relevant theories. The concepts and connotations of accounting information quality and emerging technologies are summarized and analyzed. The fourth section of this study analyzes the influence of emerging technologies on the quality of accounting information. In the fifth section, the challenges of improving the quality of accounting information in the context of emerging technologies are studied. The sixth section is the analysis of the construction of an accounting information standard system based on emerging technology. The seventh section is the discussion of the study. The final section is the conclusion.

2. Methodology and Descriptive -Analysis

2.1. Collection of literature

There has been a significant increase both in scholarly study and in the practical application of emerging technologies. Simultaneously, emerging technologies are enhancing the quality of accounting information; there is a growing body of study in the accounting field on these technologies. This study employs systematic literature review research method to investigate the quality of accounting information facilitated by emerging technologies including blockchain, artificial

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intelligence, big data, cloud computing, and the Internet of Things. The analysis is conducted using the Web of Science database, focusing on the temporal and spatial development trends of relevant thematic literature as well as on the distribution of literature publications.

Based on the search conducted, it was found that a total of 233 articles about the topic of "accounting information quality" were included in the Web of Science database. Considering the application of emerging technologies in the field of accounting, further searching with the keywords "accounting and blockchain, artificial intelligence, big data, cloud computing, Internet of Things", a total of 322 articles were found. Among them, it is found that a significant amount of the study literature pertains to blockchain technology. Specifically, there are a total of 101 papers, constituting 31.4% of the entire body of literature on the subject. Considering the potential for errors, a comprehensive search with the phrase "accounting and technology" yielded a total of 492 articles. Meanwhile, according to the knowledge graph of keywords in Figure 1, the research hotspots are distributed in "accounting, information, blockchain, technology, algorithms", etc., and the research objectives are "impact, future, business, service system, performance evaluation", etc. Hence, the investigation into the enhancement of accounting information quality using emerging technologies is supported by a solid theoretical foundation in existing literature, thus rendering the research viable.

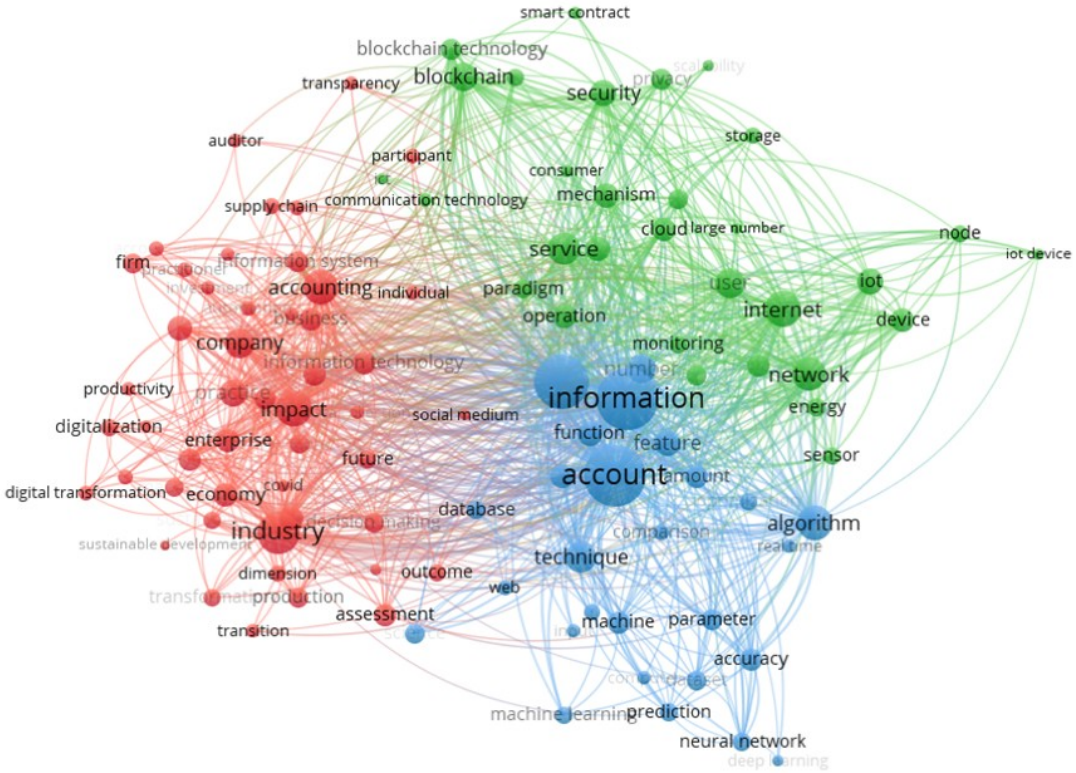


Figure 1. Keywords and Center Nodes

2.2. Literature Analysis

2.2.1. Analysis of Literature

At this stage, the data undergoes visualization analysis. The research literature on "accounting information quality" is mainly concentrated after 2010, increasing from 9 articles in 2010 to 25 articles in 2022. Meanwhile, with the development of emerging technologies, the research literature

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on "accounting + emerging technologies" is mainly concentrated after 2018, increasing from 28 articles in 2018 to 79 articles in 2022, with a growth rate of 182%, reaching a peak in 2022. The application of emerging technologies in the field of accounting is still a hot new topic, as evidenced by the 322 chosen scholarly articles, which garnered an average yearly citation count of 257 between the years 2013 and 2022.

Subsequently, a thorough analysis was conducted on the chosen 322 articles using the citation report. Additionally, the selected articles were further refined, considering the topic's relevance. Finally, 269 articles related to accounting information quality and emerging technologies were selected. Meanwhile, according to Figure 2, it can be found that the studies on emerging technologies' empowering accounting information were concentrated after 2018.

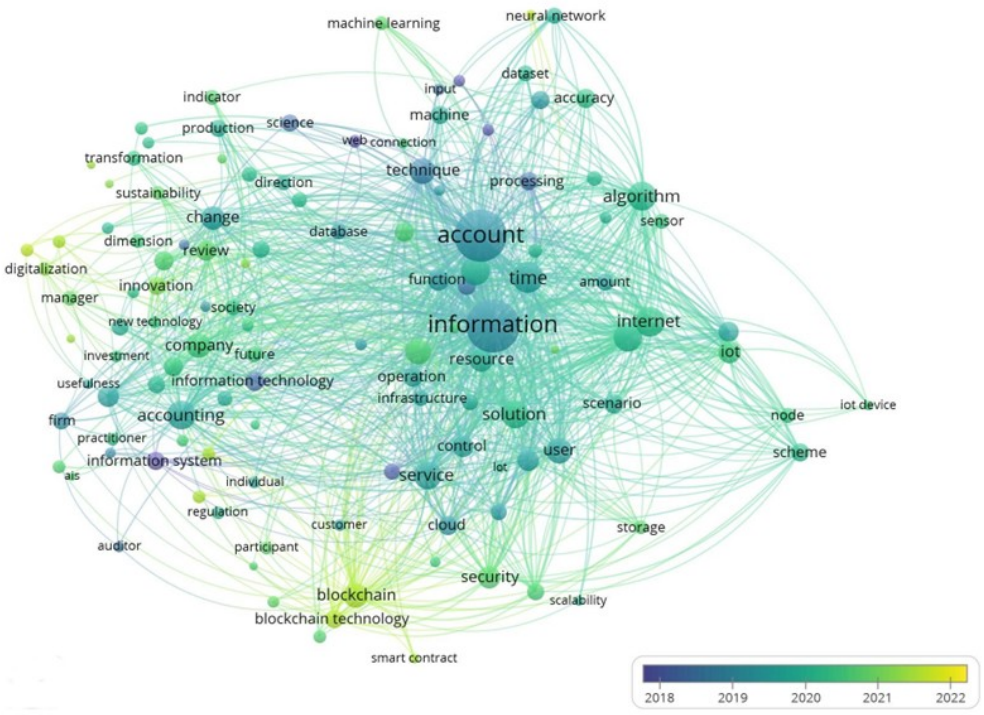


Figure 2. Knowledge Graph of Research Topics

The following table (Figure 3) shows the specific publication and citation volume of the relevant papers from 2013-2022.

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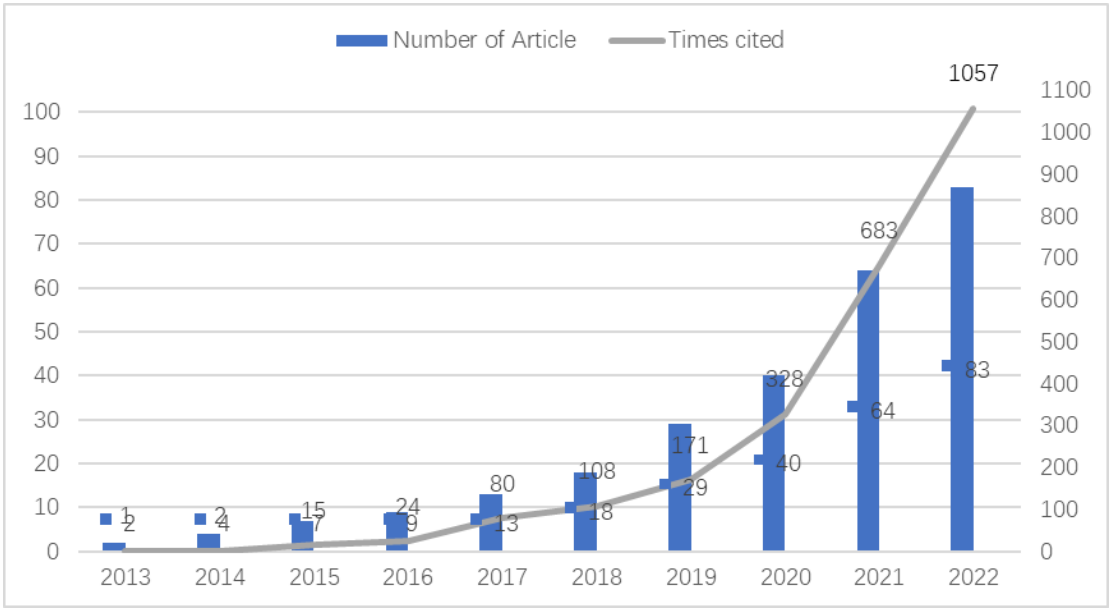


Figure 3. Publication Volume and Citations (2013-2022)

2.2.2. Spatial Analysis of Literature

Based on the analysis of the source countries of published literature, as can be seen from the knowledge graph of publication countries in Figure 4, the top three countries in terms of publication volume are China, the United States, and England. This is directly ties to the mature accounting standards and robust new technological development in these three countries. Other countries with publications are Australia, Italy, and Spain.

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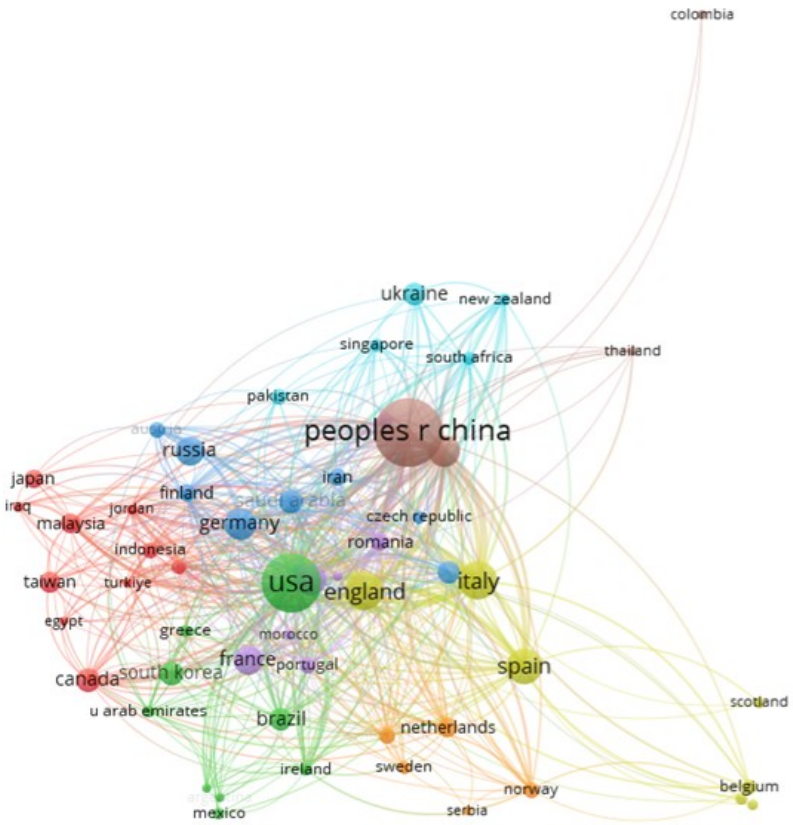


Figure 4. Countries of Publication

See Table 1.

Table 1. Distribution of the Top 10 Countries in Terms of Publications

Country/Region	Number of papers	Proportion (%)
CHINA	110	34.161%
USA	67	20.807%
ENGLAND	26	8.075%
AUSTRALIA	20	6.211%
ITALY	12	3.727%
SPAIN	11	3.416%
CANADA	10	3.106%
GERMANY	7	2.174%
FRANCE	7	2.174%
RUSSIA	6	1.863%

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Based on the analysis of the journal distribution of published literature, the analysis of the publishing knowledge graph shown in Figure 5 reveals a notable concentration of research literature related to the subject matter inside prominent academic journals such as IEEE Access, Sustainability, the IEEE Internet of Things Journal, and the International Journal of Accounting Information Systems. There are a total of 169 publications in the field of economics and management, while 153 publications fall within the realm of computer science.



Figure 5. Distribution of Journal Publications

3. Background and Theoretical Foundations

3.1. Definition and Characteristics of the Quality of Accounting Information

There are multiple perspectives on the meaning of accounting information, as follows. In the first perspective, accounting information essentially belongs to a kind of economic information that is provided by enterprises so that the users of accounting information can understand the operation of enterprises (Bushman, & Smith, 2001). The second perspective is that the quality of accounting information is closely linked to enterprise value. The allocation of information resources has a significant impact on the "external performance" of company value production. Accounting information has a significant role in several aspects of company operations, including enterprise strategy, corporate governance, and internal control. Its influence on the creation of enterprise value is profound (Napitupulu, 2023; Kwakye & Ahmed, 2024). The third perspective posits that accounting information possesses the characteristic of measurability. While it is relatively simple to measure historical information about economic activities that have taken place, it is more challenging to measure information about economic activities that are predicted in the future. In their study, Ball et al. employed a nonlinear accrual model to assess the quality of accounting information. This model, in contrast to the traditional linear accrual model, demonstrated superior predictive capabilities for future cash flows by effectively recognizing losses (Ball & Shivakumar, 2006). Subsequently, many scholars have adopted the Jones model and the surplus smoothness model to further measure the quality of accounting information (Nelwan, Simatupang, & Tansuria, 2020). Therefore, accounting

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information is a kind of economic information, which reflects the movement of enterprise value and can be measured.

The evaluation of accounting information's value relies significantly on the quality of the information (Bushman, Chen, Engel, & Smith, 2004). Various organizations in different nations have conducted extensive research on the characteristics of accounting information quality from multiple angles, aiming to enhance the understanding of its meaning. The notion of the qualities of accounting information was initially proposed by the American Accounting Association (AAA) in 1966. Subsequently, in 1980, the Financial Accounting Standards Board (FASB) of the United States of America further divided and hierarchized the characteristics of accounting information in detail. According to the FASB's study, the degree of quality of accounting information is determined by how helpful it is to users in making decisions. The quality of accounting information is assessed through the establishment of multiple levels of indicators, such as relevance and reliability.

Along with the accelerated trend of internationalization of accounting standards, in 1989, the International Accounting Standards Committee (IASC) conceptual framework argued that, in addition to focusing on relevance and reliability, it should also focus on the understandability of information. Furthermore, the framework aims to provide national comparability of accounting standards, thus forming a system of accounting information quality with understandability, relevance, reliability, and comparability as its main characteristics(Zeff, 2012).

The Accounting Standards Board of the United Kingdom (ASB) published a report in 1990 that examined the quality of financial information. This report categorized the system of characteristics of accounting information quality into two main categories: content quality and presentation quality. Additionally, the report introduced the concept of completeness as a characteristic of accounting information quality(Bengtsson, 2011).

According to the 2006 Chinese Accounting Standards for Companies (CAS), the features of accounting information quality are defined as truthfulness, relevance, comparability, clarity, substance over form, importance, timeliness, and prudence. In 2018, the International Accounting Standards Board (IASB) developed a novel conceptual framework that classified the quality attributes of accounting information into two distinct categories: fundamental requirements and enhancement requirements. Furthermore, it is worth noting that the accounting information quality characteristics put forth by different nations include the notion of cost-benefit qualification. This emphasizes that the benefits obtained from accounting information should exceed the associated costs.

With regard to the attribution of accounting information quality characteristics, FASB, IASC and ASB have incorporated accounting information quality characteristics into the national conceptual framework for financial accounting; they have adopted the "decision-usefulness view" as the core guiding principle. In comparison, the quality of accounting information in China is more inclined to the "fiduciary responsibility view" but, with the dual disclosure of financial and management accounting information, it is gradually developing towards the dual goals of "decision-useful view" and "fiduciary responsibility view." The "dual objectives" of accounting information decision-making are, therefore, most relevant when considering the "quality requirements" for accounting information, which include authenticity, relevance, comparability, and timeliness.

In order to enrich and improve the characteristics of the quality of accounting information, the International Accounting Standards Board (IASB) released a new version of the framework of the

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system of quality characteristics in 2018. It explicitly states that, when applying the basic quality characteristics, it is necessary to weigh the relationship between relevance and truthfulness, which is in line with the current technological innovation and development.

See Table 2.

Table 2. Chronology of the Development of Definitions of the Quality of Accounting Information

	Connotation of the quality of accounting information	Source
International	Decision usefulness is the most important information quality characteristic. The primary quality characteristics are relevance and reliability, and the secondary quality characteristics are comparability and consistency.	FASB 1980
	The fundamental criteria of understandability, relevance, dependability, and comparability are of paramount importance.	IASC 1989
	Sort the qualities of accounting information quality into two categories: presentation-related qualities and content-related qualities.	ASB 1990
	Differentiate between the fundamental and the enhanced quality characteristics of the quality of accounting information.	IASB 2018
China	Truthfulness, relevance, comparability, clarity, substance over form, importance, timeliness, and prudence.	CAS 2006

3.2. Emerging Technologies Related to Accounting Scenarios

The application of emerging technologies has a significant impact on the accounting environment and financial behavioral patterns, leading to a transformation in the ecosystem of accounting information, accounting business processes, the focus accounting tasks, and accounting regulatory efforts (Yoon, 2020). Emerging technology accounting applications refer to the utilization of information and data technologies in the many operations of accounting, including recording, computation, reporting, and storage (Fikri, Rida, Abghour, Moussaid, & El Omri, 2019). The development of emerging technologies as part of the accounting environment promotes the development of accounting and has a profound impact on the quality of accounting information. The technology economy and the booming sharing economy, as well as various emerging technologies including blockchain, artificial intelligence, cloud computing, big data, and the Internet of Things (IoT) have gained extensive utilization within the accounting field. Blockchain technology establishes trust among users, while artificial intelligence (AI) enables the rapid and efficient extraction of information. Cloud computing enables timely access to resources, and big data analytics ensures accurate processing of data. Additionally, the Internet of Things (IoT) realizes data integrity (Pazaitis, De Filippi, & Kostakis, 2017).

Blockchain is a type of technologically enabled ledger. The autonomous operating rules of blockchain can create trust for unfamiliar accounting subjects (nodes). Blockchain has the potential to solve the information asymmetry problem by realizing public ledger record features like inerrancy, encryption,

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security, decentralization, openness and transparency, open sharing, traceability, etc. (Centobelli et al., 2022). The recording, storing, and transmission of all transaction credits in the big data format across many computers and network nodes can be included in the category of accounting information, with the generalization of the concept of accounting information (McCallig, Robb, & Rohde, 2019). However, with the arrival of big data in accounting, new problems, such as fraud in accounting data, a declining trust in accounting, and the degree of data sharing being out of sync with the need for decision-making, have emerged (Yu, Lin, & Tang, 2018). The blockchain, a pure technology, can synchronize transaction data across nodes between different databases; this is expected to solve many current difficulties in the generation of accounting information (McCallig, Robb, & Rohde, 2019).

Artificial Intelligence (AI) is an emerging technological science that researches and develops theories, technologies, and application systems used to simulate and extend human intelligence. It employs efficient data processing and data analysis techniques to investigate the ways in which computers might be made to perform intelligent tasks that, in the past, only humans could achieve. When AI is applied to the field of accounting work, AI incorporates the concept of big data and cloud computing technology to generate an intelligent system that combines humans and machines to replace manual bookkeeping and reporting. The obtained accounting information is analyzed with the help of an expert system that simulates human thinking to support forecasting and decision-making. Accounting AI technology can considerably increase the accuracy and the timeliness of accounting information, can decrease expenses, can optimize the accounting process, and can further improve the level of financial management, thus realizing the modernization of accounting work (Luo, Meng, & Cai, 2018).

Cloud computing is a technological system that enables the unfolding of efficient access to a predetermined shared pool of computing resources, notably networks or services. Cloud computing includes three main elements: software, platform, and infrastructure. In cloud computing, server locations and access patterns can be in different distribution models, such as on public, private, community and hybrid clouds. This allows enterprises and governments to choose the right cloud system, according to their demands, so that they may fulfill their information processing requirements. Cloud computing ensures that all stakeholders have access to up-to-date and accurate financial information (Ogiela, 2015). Also, cloud computing has gradually supplanted traditional accounting software; cloud-based accounting systems offer the advantages of real-time collaboration and data centralization, decreasing data duplication and enhancing data consistency.

The term "big data" was initially introduced by (Viktor et al., 2020) in their publication titled The Age of Big Data. Big data refers to a collection of data on a very large scale, with a huge data volume and powerful process optimization capabilities. In contrast to conventional database software, "Big Data" has enhanced capabilities in terms of data acquisition, storage, analysis, and management. The emergence of "big data" provides strong technical support for accounting artificial intelligence in data collection, statistical analysis, data mining, and other aspects (Bose, Dey, & Bhattacharjee, 2023).

The Internet of Things connects objects to the Internet through various types of information-sensing devices, thus realizing the intelligent exchange of object information, positioning, and informatization management (Wortmann & Flüchter, 2015). The Internet of Things is a product of the development of the knowledge economy, which highly combines physical objects and information, and which offers

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two major advantages. First, it realizes the direct correlation between physical objects and information data. The modern tracking technology has a significant qualitative improvement. This has enabled enterprises to benefit from advanced intelligent systems that assure the accuracy and reliability of information. Consequently, the Internet of Things aids in decision-making processes and contributes to the enhancement of economic efficiency. Secondly, it enables the instantaneous processing of information and mitigates the influence of human data input. The Internet of Things (IoT) facilitates the synchronization of physical and informational updates, providing ease of management and enabling enterprises to handle data in real time. IoT devices provide real-time data streams that accurately reflect the use, status, and movement of material resources. The utilization of real-time data enhances the precision of asset assessment, depreciation calculations, and the efficiency of financial reporting (Santoro, et al., 2018; Valentinetti & Muñoz, 2021).

4. The Influence of Emerging Technologies on the Quality of Accounting Information

This study utilizes the Conceptual Framework for Financial Reporting established by the International Accounting Standards Board (IASB) to analyze the implementation of emerging technologies, including blockchain, artificial intelligence, big data, cloud computing, and the Internet of Things (IoT), within the accounting field. The objective is to assess the influence of these technologies on the quality of accounting information. This study aims to provide a summary and analysis of the three aspects of accounting information quality characteristics within the context of "emerging technology + accounting." These dimensions include fundamental characteristics, enhanced characteristics, and the cost-benefit principle.

4.1. The Influence of Emerging Technologies on Fundamental Quality Characteristics of Accounting Information

The fundamental quality characteristics include relevance and truthful reflection, emphasizing that useful financial information must be relevant and consistent with its intention to truthfully reflect the content (Palazuelos, Crespo, & del Corte, 2018). The relative significance of relevance within the "information view" and truthfulness within the "measurement view" of accounting information quality characteristics has been a subject of ongoing scholarly discourse. Academics in the United States have placed significant emphasis on the key characteristic of accounting information being its relevance, but China has consistently prioritized the fundamental principle of truthfulness. However, Dai et al. discovered that, via the profound integration of emerging technologies and accounting, the utilization of emerging technologies can simultaneously realize the relevance and truthfulness of accounting information (Dai & Vasarhelyi, 2017).

4.1.1. The Utilization of Emerging Technology Improves the "Truthful Reflection" of Accounting Information

The requirement for truthful reflection of the quality of accounting information means that, within the accounting process (namely accounting recognition, recording, measurement, and reporting), the company must rely on the actual occurrence of transactions or events. This is done to truthfully reflect the accounting elements and other accounting items in accordance with the established accounting standards. The objective is to ensure that the resulting accounting information is true, reliable, and comprehensive. Furthermore, it is crucial to fully disclose the authentic accounting information to users, in order to provide them with reliable references for decision-making purposes.

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As a result of the widespread adoption of financial software, accounting information data has transitioned entirely to electronic formats. According to the research of relevant scholars, several factors have been identified as influential in determining the truthful reflection of accounting information quality in the context of emerging technology. These factors include (1) the authenticity of the accounting object; (2) the accounting processing process and the disclosure of the accounting information; (3) the immutability of the accounting data; and (4) the normativity to accounting standards. These are the links and the key elements of the accounting information processing procedure that may affect the truthful reflection of the quality of accounting information.

(1) Accounting Objects

Presently, businesses widely adopt multi-dimensional big data to describe accounting objects on a large scale. By combining blockchain technology with big data, businesses can enhance the authenticity of accounting by more comprehensively depicting and restoring the original form of economic operations (Zhang, et al., 2020). Within the realm of new technology, the economic business object undergoes complete digitization. This process is facilitated by the utilization of the blockchain consensus mechanism, which ensures that numerous parties simultaneously confirm the occurrence and processing of business activities (Xie, et al., 2023). Meanwhile, the rise of cloud computing and the use of big data have made multidimensional, third-party computing and cloud storage a reality, providing the basis for the realization of accounting information technology systems (Li, et al., 2020). Blockchain technology and big data will combine and co-evolve to create an evolutionary whole that includes the digital accounting items used in human socioeconomic activity.

(2) Accounting Processes and Disclosure

Blockchain uses automated software technology for accounting information processing, and the whole process of accounting information encryption and hash calculation results in a blockchain-type data record which ensures the traceability of accounting data (Zhu et al., 2019). Furthermore, the authenticity of the data is verified through IoT technology, which improves the authenticity of accounting data from the whole process (Xu et al., 2020).

(3) Immutable Accounting Data

The technical advantages of blockchain information technology in accounting applications and processing are manifested in decentralization. Accounting records are backed up and stored on the server nodes of all users, making it impossible for any single accounting subject to change the overall data; this can effectively inhibit most of the accounting and financial fraud (Yu et al., 2018). Big data technology overcomes the limitations of sample selection by using the overall sample to replace the traditional random sampling; this significantly improves the representativeness of the sample and reduces the subjectivity of accounting business personnel in sample selection (Nissim, 2022). Furthermore, the expert system and pattern recognition system in accounting AI will use financial data and accounting models to make reasoning and judgments to automatically identify false economic business information and related financial data; this will further improve the authenticity of accounting information (Gray et al., 2014).

(4) Accounting Standards

The implicitization of accounting standards is taking a new trend with smart contracts on blockchain. Accounting standards must be reformulated to include the new technology within the existing legal

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framework. All embedded procedures must be authorized and validated by the state. Simultaneously, the accounting field has become fully intelligent and automated, due to the application of emerging technologies. Accounting theories are increasingly implicitly embedded in the rules of distributed platforms; this will eventually result in the digital programming of the implementation of accounting standards (Monteiro et al., 2020).

See Table 3.

Table 3. Relevant Literature: Emerging Technologies and Accounting Information Truthfulness

	The influencing factors	The technical functions of emerging technologies	Representative literature
The Truthful Reflection of Accounting Information	The accounting Objects	The Consensus Mechanism of Blockchain	Xie et al. (2023)
		Third-party computing in cloud computing	Shen et al. (2022)
		The Cloud Storage in Big Data	Li et al. (2020)
	The accounting process	Blockchain message encryption and hash calculation	Zhu et al. (2019)
		The recognition and management of objects for the Internet of Things	Xu et al. (2020)
	The accounting data	The decentralization of blockchain technology	Yu et al., 2018
		The data Selection for Big Data	Nissim et al. (2022)
		The expert systems in artificial intelligence	Gray et al. (2014)
	The accounting standard	Blockchain-Based Smart Contracts	Monteiro et al. (2020)

4.1.2. The Utilization of Emerging Technology Improves the "Relevance" of Accounting Information

The relevance of the quality of accounting information refers to its capacity to sufficiently fulfill the requirements and inherent expectations of those who utilize such information (Azar et al., 2019). Accounting information that is deemed relevant should have either predictive support value, decision support value, or both. Predictive support value implies that the information can assist users in

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making future predictions, while decision support value refers to the information's ability to offer feedback or guidance on previous accounting estimates. The relevance of the quality of accounting information in the context of emerging technologies primarily depends on the extent to which accounting information aligns with the requirements of information users, the decision-making utility of the accounting information, and the predictive capabilities of accounting information.

(1) Emerging technologies will better match accounting information with the needs of information users

In the current epoch characterized by the Great Intelligence Cloud, the accessibility of information has significantly increased. The public ledger of the blockchain enables accounting information to be truly and fairly accessible to the general public. A blockchain that is collectively maintained enables information users to function as information producers simultaneously. Each information user is more likely to independently express their interests and needs in the production process of accounting information in a unique general ledger (Vijai et al., 2019). At the same time, enterprises can obtain various forms of data, whether structured or unstructured, according to their needs, and can analyze them to help them make decisions. According to Khaldoon et al., data mining technology can enable enterprises to gather useful information, leading to more timely and more accurate financial reports that can enhance the relevance of such reports to the financial situation of the firm (Al-Htaybat & von Alberti-Alhtaybat, 2017).

(2) Emerging technologies enhance the decision-support value of accounting information

The application of emerging technologies enhances the whole societal decision-making efficiency of accounting information. According to Ricardo's theory of the marginal efficiency of capital, the application of emerging technologies shortens the chain of recording, reconciling, and reporting of company accounting information. It simplifies the process of transferring accounting information, reduces a variety of costs and regulatory difficulties, and improves the efficiency of accounting information processing (Nell, 2011; Cooper et al., 2019). Therefore, the application of emerging technologies effectively reduces the zero-sum game generated by accounting invalid information, and the total social wealth realizes effective Pareto improvement. On one hand, the distributed ledger decreases the marginal cost of getting information for accounting information users. Blockchain accomplishes the replication of accounting record data by applying the Paxos algorithm, which minimizes the error rate of accounting records backed up across multiple accounting subjects and enhances the marginal efficiency of accounting information (Xiong et al., 2022). On the other hand, the application of emerging technologies enables open, real-time, transparent, and shared accounting information, which achieves a separating equilibrium in the economy. This is the key to emerging technologies' ability to make the decision-making of accounting information users more effective (Warren et al., 2015).

(3) Emerging technologies enhance the predictive support value of accounting information

Under the trend of the era of comprehensive upgrading of emerging technologies, enterprises need to have a keen information processing ability to cope with the huge and rapidly updated information group. In the highly competitive market, this capability may help enterprises stay competitive. With the use of artificial intelligence, cloud computing and other technologies, enterprises can improve the efficiency of information processing, consequently enhancing the quality of accounting information and accurately predicting the direction of market development (Gill et al., 2019).

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Simultaneously, big data leverages strong information retrieval technology to quickly identify market needs, to combine structured and unstructured data, and to build a comprehensive information collection and statistical system. A structured prediction and decision-making system is further built to improve the accuracy of prediction and decision-making (Lee, 2017).

See Table 4.

Table 4. Literature on Emerging Technologies and Relevance of Accounting Information

	The influencing factors	The technical functions of emerging technologies	Representative literature
The Relevance of Accounting Information	The extent to which accounting information matches the needs of information users	The Public Ledger for Blockchain	Vijai et al.(2019)
		Data Digging	Khaldoon et al. (2017)
	The value of accounting information decision support	Artificial Intelligence Automation	Cooper et al. (2019)
		The blockchain Paxos algorithm	Xiong et al. (2022)
	The value of accounting information forecasting support	Big Data Information Retrieval Techniques	Lee et al.(2017)

4.2. The Influence of Emerging Technologies on the Enhanced Quality Characteristics of Accounting Information

The enhanced quality characteristics include comparability, verifiability, timeliness, and understandability. While these enhanced characteristics can improve the usefulness of accounting information, they are not necessary to make accounting information useful. The essential condition is that accounting information must adhere to the fundamental quality characteristics, including the requirements of truthfulness and relevance. If the accounting information already meets the fundamental requirements and is subject to the limitations of the quality characteristics, the enhanced quality characteristics can be further optimized to increase the usefulness of accounting information.

4.2.1. The Utilization of Emerging Technology Improves the "Comparability" of Accounting Information

When analyzing the adequacy of accounting information, it is possible to adopt two distinct viewpoints: horizontal comparability and vertical comparability. Horizontal comparability refers to the need to ensure that, when comparing the accounting information of different companies, the accounting policies and the calibers on which they are based are consistent. Vertical comparability,

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on the other hand, refers to the fact that the same or similar economic transactions of the same company at different points in time should be treated by consistent accounting standards. The core principle of comparability lies in adhering to and correctly implementing accounting methods and processing procedures which should not be changed arbitrarily (Chen & Gong, 2019). There are many factors affecting the comparability of accounting information, accounting standards (Huang et al., 2020), information asymmetry (Blue et al., 2020), internal control of enterprises (Li et al., 2022), and so on (Huang & Yan, 2020; Blue et al., 2020; Li et al., 2022).

In the context of emerging technology, accounting records are completed by a third party through a consensus mechanism. The accounting function inside the accounting body has been replaced by the automated execution of accounting processes facilitated by technology. Big data analysis is used in the decentralized platform's operation to oversee the accounting system's implementation by the government, shareholders, boards of directors, accounting institutions, etc. The utilization of emerging technologies enhances the oversight of accounting standards, thereby the arbitrariness of the implementation of accounting standards, and it essentially resolves the issue of inconsistent accounting information (Huang & Yan, 2020). Furthermore, in practice, there exists an information asymmetry between the information producer and the user. The information producers, who possess a substantial amount of accounting information, influence the generation and dissemination of accounting information based on their comprehensive understanding of the transaction.

This, in turn, diminishes the comparability of accounting information and then triggers moral hazard. The principle of blockchain accounting by third-party bookkeeping helps to reduce the problem of information asymmetry and further improves the comparability of accounting information (Blue et al., 2020; Bonsón & Bednárová, 2019). Finally, the application of emerging technologies will trigger significant changes in the way in which enterprises operate and manage their business, including breaking traditional organizational boundaries, changing internal and external contact methods, and achieving system interconnection and data sharing. This will drive enterprises to adopt smart contracts, form new organizational structures, improve internal control, and provide basic conditions for the comparability of accounting information (Li et al., 2022; Murray et al., 2021).

4.2.2. The Utilization of Emerging Technologies Enhances the "Verifiability" of Accounting Information

As an important sub-characteristic of truthfulness, verifiability is essential to reducing the risk of fraud and to the auditing process, particularly in capital markets where disclosure quality is often inadequate. In the past, information in the accounting system was fragmented, and information involving economic phenomena was dispersed among different intra-enterprise systems and different accounting subjects, leading to difficulties in verifying the relationship between information. The accounting application of emerging technologies has improved the information-sharing mechanism, generating a comprehensive chain of interconnected accounting information, hence simplifying the validation process of accounting information (Si et al., 2019).

An advanced accounting information system has been developed by integrating blockchain, artificial intelligence, big data, cloud computing, and the Internet of Things. This integration significantly improves the capacity to verify accounting information. On the one hand, a new generation of accounting ledgers that integrate blockchain, IoT, and other technologies can guarantee the security and the validity of the content data and the documents that they include. By utilizing blockchain technology to record inventory information and by employing IoT to track the historical track of

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inventory, electronic invoices, shipping bills, and other related documents, it is becoming possible to monitor the real-time data of these documents and to ensure their authenticity (Wu et al., 2019).

In addition, smart contract technology can be used for quick verification of transaction records according to accounting standards, realizing real-time verification of accounting information (Fauziah et al., 2020). On the other hand, artificial intelligence and data analytics techniques can extract valuable information from unstructured big data. This information can be used to validate accounting information from different perspectives; for example, the authenticity of sales operations can be verified by reputation information on social media (Gupta & George, 2016).

4.2.3. The Utilization of Emerging Technologies Enhances the "Timeliness" of Accounting Information

The concept of timeliness in accounting refers to the prompt recognition and recording of economic transactions during the relevant accounting period, without any undue acceleration or delay. The recognition and reporting of accounting information are essential during the accounting process. In the conventional method of information processing, the accounting information of enterprises is dependent on the transmission and communication between various departments. However, this approach is incongruous with the information disclosed by the industry in the market, thereby constraining the relevance of accounting information. This asymmetry of information affects the quality of decision-making in enterprises, which brings potential risks and adversely affects the survival and development of enterprises (Conover, Miller, & Szakmary, 2008). Hence, the significance of emerging technologies in enhancing the timeliness of accounting information becomes evident.

On the one hand, the utilization of big data technology in constructing a financial sharing platform enables the prompt processing and dissemination of accounting information. This platform can simplify the internal information transfer process, enhance the efficiency of information circulation and work productivity, and optimize the internal operations of the organization to ensure the timely availability of accounting information (Qiu & Xiao, 2020). On the other hand, blockchain technology aims to realize the integration of business and finance, so that transactions and bookkeeping are carried out simultaneously. Blockchain technology has the capability to eliminate the need for intermediaries and centralized institutions to authenticate through timestamps. This enables the seamless movement of assets and value while it concurrently facilitates the transmission of information. Upon recognizing this integration, blockchain technology combines with big data to achieve full codification of accounting information data processing with high speed, high efficiency, and high accuracy. The integration of artificial intelligence is employed to achieve complete automation in the process of collecting accounting data. The application of emerging technologies makes the collection of accounting information in a timely manner.

4.2.4. The Utilization of Emerging Technologies Improves the "Understandability" of Accounting Information

Accounting information quality requirements' comprehensibility refers to the need to classify, organize, and describe accounting information in a clear and concise manner so that it is easy for investors and other users of financial reports to understand and use. Nevertheless, the existing standardized financial reports provide a challenge due to their extensive and complex material, making it difficult for users of information to effectively comprehend economic management phenomena (Al-Htaybat & von Alberti-Alhtaybat, 2017).

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The theoretical framework of "emerging technology + accounting" facilitates the generation of several types of financial reports, encompassing both structured and unstructured data. The use of visualization tools has become crucial for preventing information overload and for enhancing the comprehensibility of accounting information. The rise of big data has driven the development of visualization tools. These tools can present complex analysis results in an intuitive and understandable way, presenting accounting information through graphs, images, and animations to make it easier to understand and use (Cohen et al., 2022). Furthermore, by use of data linkage, individuals have the ability to track the sources and changes in information; this helps in understanding accounting information in greater depth.

4.3 The Impact of Emerging Technologies on the Restrictive Characterization of the Cost-effectiveness of Accounting Information

According to the International Accounting Standards Board (IASB), the generation, analysis, and reporting of accounting information are closely related to costs. Rational producers of accounting information must ensure the alignment of expenses with the corresponding benefits of reporting. However, it is challenging for Generally Accepted Accounting Principles (GAAP) to effectively meet the needs of both users and producers of accounting information. Consequently, taking into account general considerations, producers of accounting information may prioritize certain features over others. However, the concurrent advancement of emerging technologies brings the possibility of the overall enhancement of various accounting information quality characteristics. On the one hand, technological advances reduce the cost of accounting information production infrastructure. On the other hand, the marginal cost of information production in the accounting information system of "emerging technology + accounting" tends to be close to zero. Hence, the utilization of emerging technologies in the field of accounting serves to mitigate the constraints associated with the cost-effectiveness of accounting information.

5. The Challenges to Improving the Quality of Accounting Information in the Context of Emerging Technologies

Although the quality of information has greatly increased due to emerging technologies, there are still some challenges to overcome. These include concerns about privacy, data security of accounting information, and the appropriate employees to receive training and skill development to use these tools efficiently.

5.1 The Issues with Data Security and Privacy Protection of Accounting Information

In the process of digitalization, the diversification of information channels and the low cost of information falsification make it easy to produce false information and to damage the interests of enterprises. It is challenging to assess the authenticity of accounting information in the market using big data technologies. On the one hand, the features of the Internet make it difficult to judge the accuracy of data related to accounting information by providing information that can be quite cumbersome to users (Alani & Alloghani, 2019). At the same time, enterprises need to disclose accounting information according to the regulations but, in the case of the popularization of emerging technologies, if the enterprise's firewall technology is not in place, it may be subject to cyberattacks, leading to leakage of core business secrets and leading to losses. Furthermore, some persons or organizations may reveal business information in the network environment arbitrarily due to bad motives or for other reasons, disregarding the significance of accounting information (Cheng, Liu,

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& Yao, 2017). Thus, with new technologies, there are issues with data leakage and security pertaining to accounting information.

5.2 Accounting Practitioners Need to Enhance Their Skills Training for Emerging Technologies in Accounting

With the development of emerging technologies, access to information in the accounting field has become more diverse and abundant. Accountants can collect and mine data through a variety of channels, but this also increases the burden of screening and judgment on information users. Because a large amount of information needs to be effectively organized and screened, there is a higher demand placed on the ability of accountants. It is necessary to be able to accurately locate and extract valuable information and to quickly screen the information needed. At the same time, the way in which accounting information is processed has also changed in the era of big data, and accountants must adjust to new ways of processing, including dealing with data of different types and complexity, understanding deep relationships between data, and applying data to higher-level decision-making forecasts. These challenges require accountants to continuously improve their information processing and analytical skills.

5.3 Emerging Technologies are Causing Changes in Accounting Transactions that Significantly Outpace the Traditional Accounting Cycle's Processing Speed

The accounting cycle is shorter, and the accounting data is more extensive. The utilization of emerging technologies has resulted in the improvement of individuals' capacity to acquire information. Additionally, the substantial volume of data related to procurement, transactions, and settlements, which affects the rules of enterprise operation and the order of market operation, makes accounting processing pay more attention to transactional accounting (Peprah et al., 2022). In the context of the dramatic increase in the amount of accounting information, a large amount of transactional data is generated; this increases the demand for accounting information users to calculate and understand the source of information on access to goods. In this instance, the financial reporting cycle of firms is abbreviated, facilitating enhanced comprehension of an enterprise's condition and bolstering investor confidence in making investment decisions. Nevertheless, the current accounting cycle, which includes monthly, quarterly, semi-annual, and annual reports, is no longer suitable for the modern era characterized by high-frequency transactions and vast amounts of data. Furthermore, it fails to establish an effective feedback mechanism between users of accounting information and accountants. Consequently, there is a need to reassess and to modify the accounting cycle.

6. Analysis of the Construction of an Accounting Information Standards System Based on Emerging Technologies

The establishment of a new generation system for standardizing accounting information has become essential for the accounting disciplines as a result of the growth of emerging technologies. The accounting information standardization system covers three links: accounting information collection, accounting information processing and transmission, and accounting information disclosure.

First, a unified database is developed as a crucial tool to fulfill the standardization of information collecting. Next, data processing and transmission work is carried out in the accounting information database with the help of cloud computing technology. Finally, to improve the degree of information sharing and provide enterprises with more timely and valuable information, the financial information,

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and the information of other departments in the enterprise are integrated using blockchain technology .

Moreover, Big data, IoT, and other technologies are also being used to combine, contrast, and analyze an enterprise's internal and external data to completely comprehend the overall situation of the industry and optimize the decision-making ability. In addition, Extensible Business Reporting Language (XBRL) has also been applied to the construction of accounting information standardization systems in recent years. The XBRL contains classification standards and innovative elemental forms of relevant data which are capable of recording and transmitting more complex economic business information.

Finally, to improve the overall quality of accounting information and to enable it to play a positive role, a platform for standardizing accounting information should also be set up with an enterprise internal control information communication system and continually optimized enterprise internal control system construction. Enterprise managers may optimize the financial management order via the ongoing enhancement of the internal control system, which enables them to carry out certain controls as well as the prevention of financial fraud .

7. Discussion

This paper offers an optimistic outlook on the quality characteristics of accounting information based on emerging technologies. The study demonstrates that emerging technologies have the potential to lead to the practice boom in accounting information, business trust, and the public ledger. Emerging technologies will have disruptive innovations in theory and in practice for the future of accounting. However, the existing literature statistics show that the research on exploring emerging technologies in the accounting field is still in the initial stage; there is no molded theoretical foundation of accounting with emerging technologies to provide reference.

Moreover, it is worth noting that emerging technologies have, indeed, enhanced the overall quality of accounting information. However, it is important to acknowledge that these advancements have not entirely revolutionized the preexisting framework of accounting information quality characteristics. In general, the trend of emerging technology-enabled accounting will not change. The emerging technologies aim to facilitate the evolution of financial accounting and management accounting and to gradually realize the transformation of the value of accounting. The following two aspects need to be emphasized in future research.

Technology is a double-edged sword, and whether it can perform its functions depends on the subjective purpose for which people apply it. For enterprises, the interests of emerging technologies in enhancing the transparency of accounting information conflict with their interests in the protection of commercial confidentiality and privacy security; this may hinder the construction of an accounting information-sharing system. Furthermore, the utilization of emerging technologies for intelligent gathering, analysis, and dissemination of accounting information will have a significant impact on the decision-making process of information users. However, it is important to note that the ultimate outcomes of decision-making mostly rely on the cognitive abilities of the users themselves. Furthermore, it is worth noting that users of accounting information often heavily depend on the accounting information intelligence system. Moreover, information users may rely entirely on the accounting information intelligence system, which lacks comprehensive analysis, and which may easily lead to the risk of being misled .

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In terms of the main body, it is imperative for technical managers, accounting authorities, accounting firms, tax authorities, and stakeholders to actively enhance the innovation of standards related to accounting theory, accounting systems, and the substance of accounting management methodologies. The company's technology managers should develop internal control systems that are compatible with emerging technologies. Accounting supervisors should learn from the "regulatory sandbox model" to change from passive supervision to active guidance and should further improve the relevant accounting theories. Accounting firms should seek ways to increase the value of their business and innovate their auditing theories, in the light of emerging technologies .

8. Conclusion

The development and the innovation of emerging technology trigger changes in the theory of accounting information quality and in the innovation of accounting application of emerging technology integration. Accounting information quality is the materialization of accounting objectives. This paper is based on the emerging technological viewpoint on the characteristics of accounting information quality. The utilization of emerging technologies in accounting has a substantial influence on the quality of accounting information, in terms of its relevance, verifiability, truthful reflection, comparability, understandability, and timeliness. Within the accounting field, this can be seen in various practices, such as in emerging technology-enabled financial reporting, emerging technology-enabled enterprise internal control and internal auditing, emerging technology-enabled accounting "business and financial integration," and so forth.

The findings of the research on the quality of accounting information from the standpoint of emerging technologies show the following beneficial effects: it effectively solves the problems of low trust in accounting between the two parties in economic activities, information asymmetry, rent-seeking, financial fraud, untimely access to accounting information for managerial decisions, low investor acceptance of accounting reports, and expensive audits. It creates an open, transparent, secure, and non-manipulated information recording and contracting mechanism. Additionally, it facilitates the realization of accounting data transparency, the synchronous updating of accounting data, accounting data sharing, lower information processing costs, and increased economic operation efficiency; in the end, it fosters the theoretical advancement and development of current data and information in the accounting, auditing, and management fields.

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Author Contributions

L.L.G.: Conceptualization of the research theme, systematic literature retrieval and screening, construction of the analytical framework for accounting information quality characteristics, writing – original draft. As the first author, she led the overall literature review design and manuscript preparation. Y.L.: Research supervision, refinement of the emerging technology application logic, manuscript review and polishing, project administration. As the corresponding author, he guided the research direction and finalized the manuscript. All authors have read and agreed to the submitted version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

Generative AI Statement

Generative artificial intelligence was used to assist with language polishing and drafting of the manuscript, as well as the initial generation of the literature distribution statistics and keyword knowledge graph diagrams. All AI-assisted content has been carefully reviewed and verified by the authors, who take full responsibility for the final content of the manuscript.

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