

Research on Financial Digitization and Information Quality Improvement

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Abstract: The traditional financial bookkeeping method needs to rely on a centralized bookkeeping system, which has the risk of single point of failure and data tampering. By adopting distributed accounting technology, all participants can have identical ledgers, and any party's accounting behavior can be quickly confirmed and verified by other nodes, greatly improving the accuracy and reliability of financial information. Therefore, this article studied distributed accounting to assist in financial digitization and information quality improvement. This article mainly used system design and data comparison to analyze the capabilities of distributed accounting systems and compare the improvement of financial information quality. Experimental data showed that in a distributed accounting system, the accuracy of financial data is over 80%, and the recall rate is over 90%. Therefore, distributed accounting technology has great potential for development, providing new standard models for financial management, improving financial digitization and information quality, and ultimately achieving automation and intelligence in finance.

Keywords: Distributed Accounting, Financial Digitization, Information Quality, Improvement Methods

1. Introduction

Distributed accounting can greatly improve the efficiency and information quality of financial digitization, making financial data more reliable, accurate, and secure. The traditional centralized accounting model has many problems, such as data opacity, easy tampering, and high operating costs. By adopting distributed accounting technology, these problems can be effectively solved, and it has higher scalability and robustness. Some data shows that through distributed accounting technology, the accuracy and real-time performance of financial information can be greatly improved, while reducing the security risks and operational costs brought about by centralized storage methods.

Distributed accounting is a digital accounting processing method based on blockchain technology, which can achieve decentralized accounting and transactions with high security and transparency. It can effectively assist in financial digitization and improve the quality of financial information. There are many theories related to researching distributed accounting systems and studying financial digitization and information quality. For example, some scholars have proposed using blockchain technology to design distributed databases and apply it to analyze data variability [1-2]. Some scholars also suggest that using blockchain technology can conduct health research on distributed accounting ledgers [3-4]. In addition, some scholars have conducted in-depth research on the risks of enterprises and the security of information management systems, proposing the impact of vulnerabilities on financial situations [5-6]. In distributed accounting systems, accounting data is stored in a chain structure to prevent data tampering and loss. At the same time, financial information can also be extracted from historical ledger data for analysis based on data structure rules, helping enterprises make financial decisions.

Comparing the advantages and disadvantages of distributed accounting systems for traditional financial information processing methods, selecting suitable financial information processing methods can minimize the cost of information extraction, operation, and maintenance, and provide high-quality and available information support for financial management within an appropriate time frame. Through the combination of off chain technology and on chain technology, research is conducted on how to integrate existing financial systems and blockchain technology, and innovate methods and approaches, in order to provide more complete technical services and decision support for financial management.

2. Financial Digitization and Information Quality of Distributed Accounting

2.1 *Distributed Accounting*

Distributed accounting is a decentralized financial data management method based on blockchain technology, which can achieve transparent, traceable, and tamper proof transactions [7]. Meanwhile, financial digitization, as a digital technology transformation, is committed to digitizing traditional financial processes and improving business processing efficiency and financial visibility of enterprises through technologies such as cloud computing, big data, and artificial intelligence.

At the technical level, distributed accounting technology and financial digitization technology have many commonalities, including data storage, encryption algorithms, smart contracts, and other aspects. The development of financial digitization technology has also promoted the in-depth application and development of distributed accounting technology, providing it with broader application fields and more comprehensive technical support. At the innovation level, the combination of distributed accounting technology and financial digitization technology can also bring new business models and business opportunities. With the support of blockchain technology, reliable cross-border trade transactions and digital management of supply chain finance can be achieved, providing enterprises with more efficient, secure, and transparent services [8]. At the level of correlation, the application of distributed accounting technology and financial digitization technology would also affect the entire industry chain. The emergence of distributed accounting technology can improve the efficiency and security of cross-border finance and cross-border payments, and change the business model of traditional banking industry. Financial digitization can help enterprises better manage processes, reduce costs, and improve efficiency. The combination of the two can not only promote the digital transformation of enterprises, but also drive the transformation of financial, manufacturing, logistics and other industrial chains.

Distributed accounting is a digital financial management method based on blockchain technology, which can achieve decentralized storage and management of data, ensure data security and authenticity, and improve the processing efficiency of financial information [9-10]. Therefore, distributed accounting is a feasible digital financial management method. With the development of digital economy, financial management also needs digital transformation to adapt to the rapidly changing business environment and constantly upgrading security needs. Distributed accounting, as a new financial management method based on blockchain technology, can meet people's needs for financial information processing efficiency, information security, authenticity, and transparency. Therefore, there is a huge development demand for distributed accounting. Traditional financial accounting usually adopts a centralized approach, requiring all accounting information to be reviewed, saved, and managed through a centralized organization. This approach poses security risks, information leakage, data hijacking, and other issues, as well as error risks caused by human factors, which affect the reliability and transparency of financial information [11]. Distributed accounting utilizes the decentralized characteristics of blockchain technology to perfectly solve these problems, and is therefore being adopted by more and more enterprises and institutions.

Distributed accounting can be applied to various financial management fields, such as account management, financial auditing, bill management, settlement and payment, etc. Specifically, distributed bookkeeping can be applied within enterprises, across enterprises, in the financial field and in various digital financial innovation scenarios, such as supply chain finance, logistics finance, digital banking and other fields. Distributed accounting, as a digital financial management method, can improve the efficiency of financial information processing, reduce operational costs, ensure information security, improve information quality, and thus promote the development of the digital economy [12].

2.2 *Financial Digitization*

As the scale of the enterprise continues to expand and the amount of information also increases, companies need to integrate their existing assets in a timely manner to improve their utilization efficiency. In the process of traditional accounting information processing, financial digitalization refers to unifying, standardizing and coding the fund movement among various departments of an enterprise, and forming a complete system. This system can reflect real-time accounting data of enterprises. By using computer technology to organically integrate various business processes of an enterprise, internal information can be unified, thereby achieving management of the entire process of the company's business activities [13]. This method not only improves work efficiency, but also

reduces costs. Financial data can be highly concentrated after processing. Due to the characteristics of mutual independence, non-interference, and infiltration among various departments, financial information becomes more comprehensive and standardized. The financial digital management organizational system is shown in Figure 1:

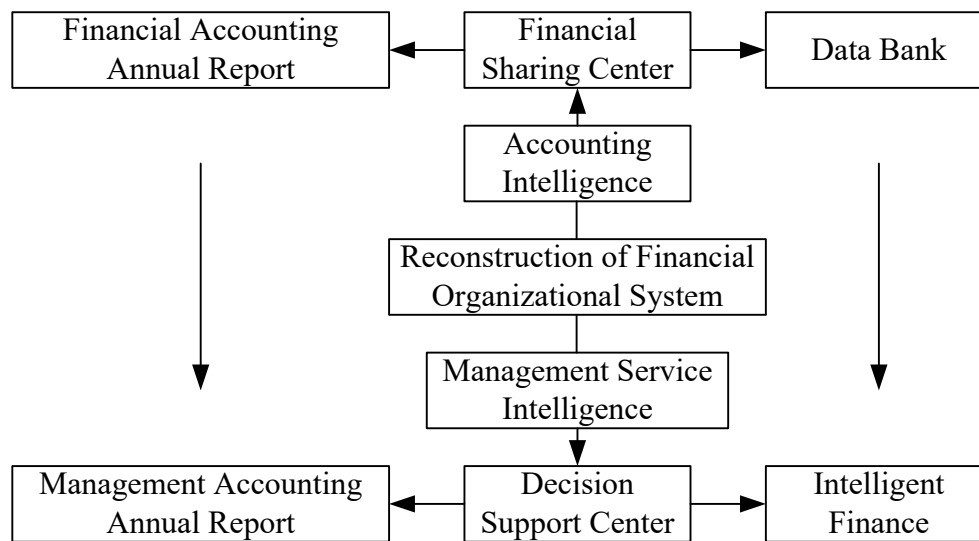


Figure 1: Financial digital management organization system

The most crucial aspect in financial digitization is the processing of data. The system used must be able to provide complete and reliable original credentials. There should be detailed and unified standards for information storage and transmission methods. From the perspective of financial software, it is operable and reliable [14]. The application of financial digitization is built on computer networks and achieved through internet technology for enterprise information sharing, data processing, and analysis. It has real-time and dynamic characteristics. Various accounting information of enterprises has been collected, processed, and stored through technologies such as computer networks. These data are used as a basis and combined with other relevant information to more accurately reflect economic activities. It can provide decision-makers with more effective and comprehensive information [15].

The emergence of financial digitization has made it easier and faster for enterprises to process various data and make decisions. At the same time, it also frees accounting personnel from tedious and repetitive work and improves their business capabilities. The accounting information of financial digitization is a relatively complete, clear, and comprehensive report obtained through a series of processing during the development process of enterprises [16]. Financial digitization is to better reflect the cash flow situation of a company during a certain period, rather than just recording a single point in time. Financial digitization is the process of collecting, organizing, and processing accounting information of enterprises to obtain valuable data based on computer electronic technology in a computer network environment. The environment of financial digitization is a complex and massive system, which includes both internal and external factors of the enterprise. Under the condition of informatization, the amount of information of enterprise financial management is increasing, and the traditional Accounting information system can no longer meet the demand. Therefore, in order to adapt to the requirements of modern society for various types of data, digitization must be achieved [17].

2.3 Distributed Accounting Systems and Information Quality

A distributed accounting system is a distributed system that involves multiple nodes participating in accounting, and its design needs to consider factors such as node collaboration, consensus mechanism, security, and scalability. In practical applications, distributed accounting systems need to ensure information accuracy and integrity, and improve information quality [18]. In order to improve information quality, the following methods can be adopted: algorithm design. Distributed accounting systems need to choose an efficient and secure consensus algorithm to ensure that each node can achieve consistent accounting results. Commonly used algorithms include Raft algorithm, Practical Byzantine Fault Tolerant algorithm, etc. In the PBFT algorithm, the preset number of network partition groups is M , and the total number of consensus nodes in the network is:

$$m = \sum_{i=1}^M m_i = Mm_0 \quad (1)$$

Number of communications during the preliminary preparation phase:

$$E_1 = m - 1 = Mm_0 - 1 \quad (2)$$

Number of communications during the preparation phase:

$$E_2 = (m - 1)^2 = (Mm_0 - 1)^2 \quad (3)$$

Regardless of whether it is cross group transactions or intra group transactions, as the number of shards increases or the probability of the main node being a Byzantine node increases, the network communication cost of double-layer consensus becomes smaller and smaller compared to the communication cost of the Practical Byzantine Fault Tolerant algorithm consensus.

Data sharing: In order to improve the information quality, the distributed accounting system needs to support data sharing between nodes to ensure that each node has the latest transaction information. **Data validation:** The distributed accounting system needs to verify each transaction to ensure the legitimacy and authenticity of the transaction. Common verification methods include public key cryptography, hash algorithms, etc. **Data backup:** In order to prevent data loss, distributed accounting systems need to backup transaction data to ensure the recoverability and reliability of the data. **Security guarantee:** Distributed accounting systems require various security measures, such as encryption, signing, and preventing network attacks, to ensure the security and stability of the system.

In order to test the information quality improvement effect of distributed accounting systems, the following evaluation indicators can be introduced: transaction success rate. The transaction success rate of a distributed accounting system is an important indicator to measure its information quality, directly reflecting the reliability and stability of the system. **Transaction processing time:** Transaction processing time is another indicator of the efficiency of distributed accounting systems, which directly affects the user experience and the feasibility of practical application scenarios. **Data accuracy:** The data accuracy of distributed accounting systems is a key indicator for evaluating their information quality, which directly affects the legitimacy and authenticity of transactions. **Data integrity:** Data integrity is one of the important indicators for evaluating the information quality of distributed accounting systems, which can reflect the completeness and traceability of information in the system. In the process of improving the quality of detection information, multiple experiments and comparative analysis are required to select the optimal design scheme and algorithm. In addition, it is necessary to continuously improve system functions and algorithms to meet practical application needs [19].

3. Design of Distributed Accounting System

3.1 Overall Structure

The main users of this system are the accounting personnel of the company. The management of enterprises can be divided into three roles: administrator, ordinary employee, and non-management personnel. They serve different types of roles and are functionally divided into two types of functional modules. By collecting and analyzing data in the distributed accounting system, all processed transactions are allocated to various functional modules according to certain rules. Each module can be interrelated with each other. The accounting centers of the enterprise have been divided and each functional module has been designed accordingly. The financial digital transformation system is shown in Figure 2.

The company's general ledger management subsystem is responsible for the input, input, and output of all data in the entire distributed accounting system. At the same time, it can also complete various voucher information and report information related content. The salary management system subsystem mainly includes two specific requirements: employee basic information registration and salary distribution. The basic information of employees is uniformly registered by the heads of each department [20].

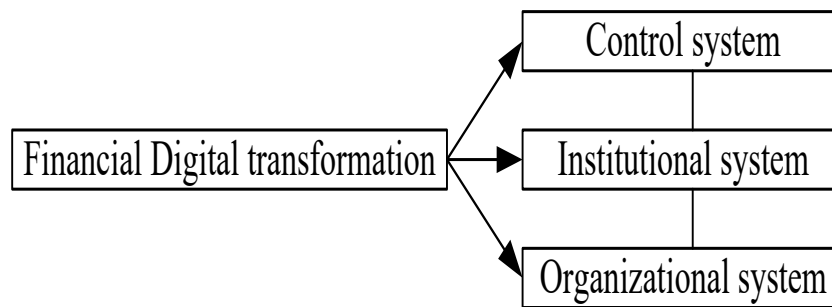


Figure 2: Financial digital transformation system

The data exchange in distributed accounting systems adopts protocols, with the aim of improving the ability of enterprises to better ensure the accounting information used in economic transactions while also reducing financial workload. Centralized protocols are distributed across the network, with each user having their own data interface, allowing each user to be divided into multiple sub nodes. When a piece of data is transmitted from that node, there is no need to establish a new connection method. At the same time, it would not affect the information exchange and other functions between other terminal devices and systems.

3.2 Development Environment

In the design and development process, there are relatively high requirements for the development environment of distributed accounting systems. The first thing to consider is computer hardware devices and software products. Secondly, it is necessary to ensure the reliability, accuracy, and timeliness of the provided information. In the design process, some advanced technologies can be adopted to improve the modularity of the system's functions. During the design process, differences in data types, storage structures, and processing methods can lead to a certain degree of difficulty in system operation. Therefore, in order to avoid this situation, it is necessary to rebuild the database. At the same time, it is necessary to ensure consistency, integrity, and compatibility between data.

For the experimental environment setting of a distributed accounting system, the following aspects need to be considered: hardware environment, including server quantity, configuration and performance, network bandwidth, etc. The software environment requires the selection of appropriate operating systems, databases, middleware, development languages, etc. to ensure the normal operation of the entire system. Database design needs to consider the design of distributed database and how to synchronize data between multiple nodes. Security requires appropriate security measures, including authentication, access control, data encryption, etc., to ensure the security of system data [21].

3.3 Methods for Improving the Quality of Financial Information

In order to study the improvement effect of distributed accounting systems on the quality of financial information, this article selects some basic financial information of local X company for analysis. This article mainly describes the asset size and inventory situation of X Company in the past three years. The specific situation is shown in Table 1:

Table 1: Inventory, current assets and total assets comparison

	2020	2021	2022
Inventory (ten thousand yuan)	412564	456782	495687
Current assets (ten thousand yuan)	536452	686431	735468
Total assets (ten thousand yuan)	578241	735266	796533
The ratio of inventory to current assets is (%)	76.9	66.54	67.4
The ratio of inventory to total assets is (%)	71.35	62.12	62.23

This article takes X Company as an example, and based on the analysis of the current situation and existing problems of inventory cost control in X Company, proposes how to use distributed accounting technology to improve these problems. Through the inventory cost system dynamics model, the causal relationship between inventory costs is analyzed, and whether the use of distributed accounting

technology can bring positive effects to the inventory cost control of the enterprise is confirmed.

To improve the quality of financial information, the following measures can be taken: verifying the source of data to ensure its completeness and accuracy. It is necessary to establish a sound internal control system to ensure the legality and standardization of data input and processing. Data analysis and inspection are conducted to promptly identify and correct data anomalies and errors. This paper establishes a standardized system for financial reporting to ensure standardized output and improve the quality of financial information. This paper also provides relevant professional ethics and literacy training to financial personnel to enhance their work level and sense of responsibility. The data sharing and collaborative processing capabilities of distributed accounting can help achieve real-time sharing and collaborative processing of financial information between different departments and locations, facilitating financial digitization and real-time updates and accuracy improvement of information. In distributed accounting systems, encryption algorithms and smart contract technology can be used to enhance data security and access control, thereby improving its security and effectively ensuring the authenticity and credibility of financial information processing.

4. Evaluation of System Test Results

4.1 Performance Evaluation of Distributed Accounting Systems

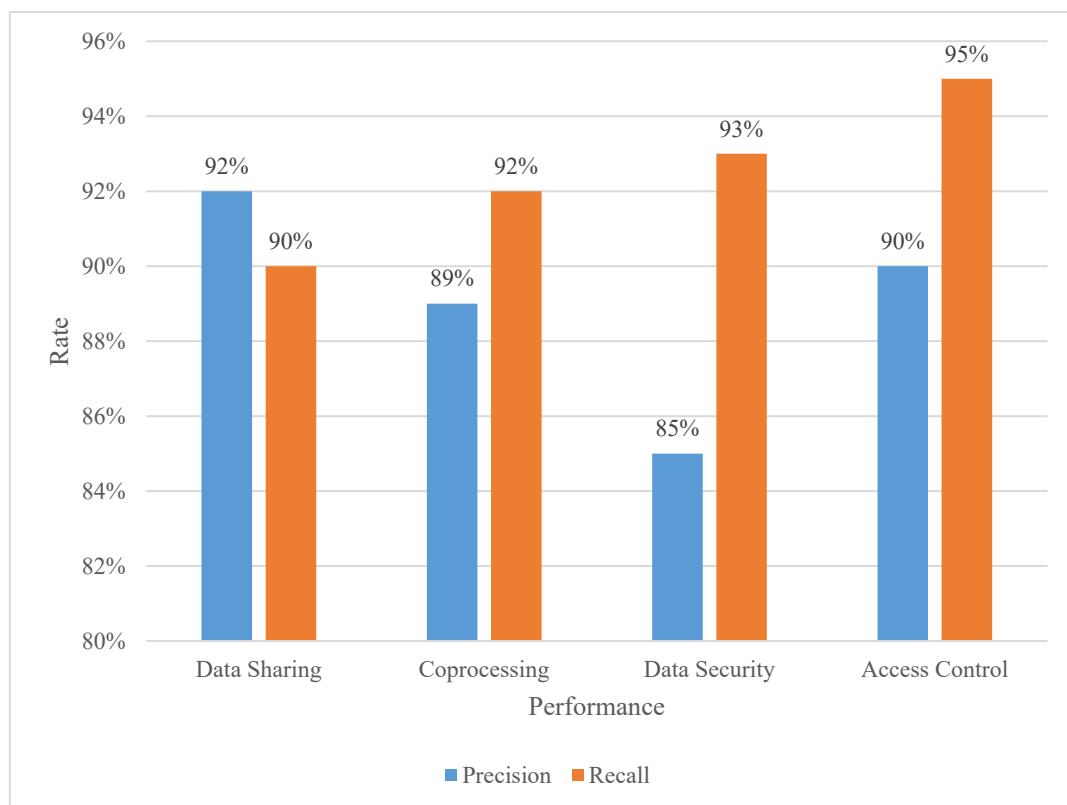


Figure 3. Performance of distributed bookkeeping system

As shown in Figure 3, it can be observed that in the distributed accounting system, the accuracy of sharing financial data has reached 92%, and the recall rate has reached 90%. The accuracy of collaborative processing capability for financial data has reached 89%, and the recall rate has reached 92%. The collaborative processing capability for data still needs to be strengthened. The accuracy of financial data security in this system has reached 85%, and the recall rate is 93%, so it is also necessary to improve data security methods. In a distributed accounting system, the accuracy of access control function is 90% and the recall rate is 95%, indicating that there is still room for improvement in the system's ability to access control.

4.2 Evaluation of Financial Information Quality

In the distributed accounting system, relevant analysis was conducted on methods for improving the

quality of financial information. The rating points were divided into 1 to 5 points in order from lowest to highest. The methods related to information quality, including verifying data, improving internal control systems, analyzing and inspecting data, standardizing financial reports, and cultivating professional competence, were rated.

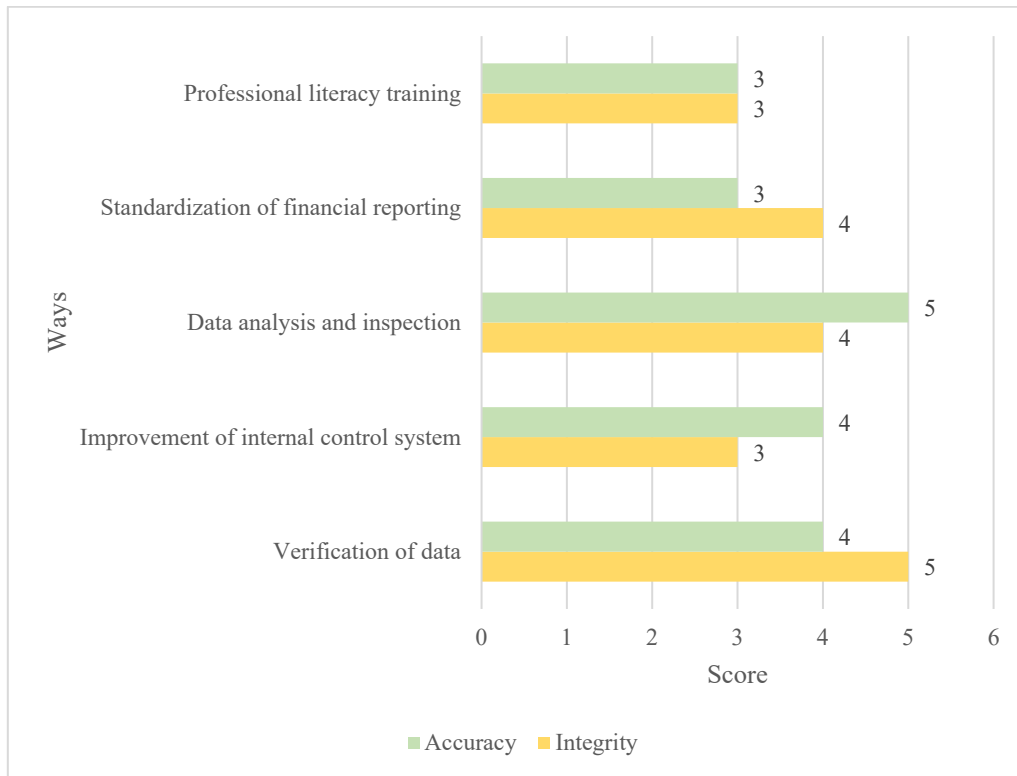


Figure 4. Information quality improvement

As shown in Figure 4, it can be observed that verifying data has a significant impact on the integrity of financial information, with a score of 5 points and a score of 4 points in terms of information accuracy. The rating for improving internal control systems in terms of information integrity is 3 points, while accuracy is 4 points. The score for data analysis and inspection in terms of financial information integrity is 4 points, while the score for data accuracy is 5 points. The standardized information integrity score for financial reporting is 4 points, while the accuracy score is 3 points.

5. Conclusions

The research focus of distributed accounting mainly includes research on blockchain based distributed accounting technology, security issues, compliance issues, and the design and construction of financial information management systems. Distributed accounting technology can effectively assist in financial digitization and information quality improvement. In addition, distributed accounting technology can also improve the efficiency and flexibility of financial digitization. For example, automated financial processing can be achieved through smart contracts, while also ensuring data privacy and security. In short, distributed accounting technology is an important means of financial digitization and information quality improvement. It can not only improve the efficiency and accuracy of financial processing, but also enhance the transparency and credibility of financial information. Distributed accounting technology is one of the future trends in financial digitization, and continuous in-depth research would help further improve the reliability and effectiveness of financial data.

References

[1] Niranjana Balachandar, Ken Chang, Jayashree Kalpathy-Cramer, Daniel L. Rubin: Accounting for data variability in multi-institutional distributed deep learning for medical imaging. *J. Am. Medical Informatics Assoc.* 27(5): 700-708 (2020)

- [2] Daniel E. O'Leary: *Some issues in blockchain for accounting and the supply chain, with an application of distributed databases to virtual organizations. Intell. Syst. Account. Finance Manag.* 26(3): 137-149 (2019)
- [3] Roberto Casado-Vara, Juan M. Corchado: *Distributed e-health wide-world accounting ledger via blockchain. J. Intell. Fuzzy Syst.* 36(3): 2381-2386 (2019)
- [4] Dnyaneshwar Ghode, Vinod Yadav, Rakesh Jain, Gunjan Soni: *Exploring the integration of blockchain technology into supply chain: challenges and performance. Bus. Process. Manag. J.* 29(1): 223-239 (2023)
- [5] Kwame Owusu Kwateng, Christopher Amanor, Francis Kamewor Tetteh: *Enterprise risk management and information technology security in the financial sector. Inf. Comput. Secur.* 30(3): 422-451 (2022)
- [6] Cansu Tayaksi, Erhan Ada, Yigit Kazançoğlu, Muhittin Sagnak: *The financial impacts of information systems security breaches on publicly traded companies: reactions of different sectors. J. Enterp. Inf. Manag.* 35(2): 650-668 (2022)
- [7] Rukma Ramachandran, Vimal Babu, Vijaya Prabhagar Murugesan: *The role of blockchain technology in the process of decision-making in human resource management: a review and future research agenda. Bus. Process. Manag. J.* 29(1): 116-139 (2023)
- [8] Komal Rauniyar, Xiaobo Wu, Shivam Gupta, Sachin Modgil, Ana Beatriz Lopes de Sousa Jabbour: *Risk management of supply chains in the digital transformation era: contribution and challenges of blockchain technology. Ind. Manag. Data Syst.* 123(1): 253-277 (2023)
- [9] Israr Ahmad, Saima Abdullah, Adeel Ahmed: *IoT-fog-based healthcare 4.0 system using blockchain technology. J. Supercomput.* 79(4): 3999-4020 (2023)
- [10] S. Anirudh, R. Shaan Sundar, Sannasi Ganapathy: *A New Cryptosystem for Secured Data Communications in Plagiarism Checking Process Using Blockchain Technology. Wirel. Pers. Commun.* 128(3): 2113-2130 (2023)
- [11] Serhan Hamal, Özlem Senvar: *Comparing performances and effectiveness of machine learning classifiers in detecting financial accounting fraud for Turkish SMEs. Int. J. Comput. Intell. Syst.* 14(1): 769-782 (2021)
- [12] Petros Kalantonis, Andreas Errikos Delegkos, Emmanouela Sotirchou, Aristidis Papagrigoriou: *Modern business development and financial reporting: exploring the effect of corporate governance on the value relevance of accounting information - evidence from the Greek listed firms. Oper. Res.* 22(3): 2879-2897 (2022)
- [13] Sajon Dhar, Mohammad Ashraful Ferdous Chowdhury: *Impact of Environmental Accounting Reporting Practices on Financial Performance: Evidence From Banking Sector of Bangladesh. Int. J. Asian Bus. Inf. Manag.* 12(1): 24-42 (2021)
- [14] Darren Bernard, Weili Ge, Dawn Matsumoto, Sara Toynbee: *Implied Tradeoffs of Chief Financial Officer Accounting Expertise: Evidence from Firm-Manager Matching. Manag. Sci.* 67(9): 5776-5799 (2021)
- [15] Renata Paola Dameri, Roberto Garelli, Marina Resta: *Neural Networks in Accounting: Clustering Firm Performance Using Financial Reporting Data. J. Inf. Syst.* 34(2): 149-166 (2020)
- [16] Diane J. Janvrin, Maureen Francis Mascha, Melvin A. Lamboy-Ruiz: *SOX 404(b) Audits: Evidence from Auditing the Financial Close Process of the Accounting System. J. Inf. Syst.* 34(3): 77-103 (2020)
- [17] Idria Maita, Saide Saide, Yelia Gusti Putri, Megawati Megawati, Medyantiwi Rahmawita Munzir: *Information system and behavioural intention: evaluating the user behaviour of financial information system in the developing country of Indonesia. Technol. Anal. Strateg. Manag.* 34(5): 594-607 (2022)
- [18] Gilles Jacobs, Véronique Hoste: *SENTiVENT: enabling supervised information extraction of company-specific events in economic and financial news. Lang. Resour. Evaluation* 56(1): 225-257 (2022)
- [19] Domenico Santoro, Luca Grilli: *Generative Adversarial Network to evaluate quantity of information in financial markets. Neural Comput. Appl.* 34(20): 17473-17490 (2022)
- [20] Lv, Z., Wang, N., Ma, X., Sun, Y., Meng, Y., & Tian, Y.: *Evaluation Standards of Intelligent Technology based on Financial Alternative Data. Journal of Innovation & Knowledge*, 7(4), 100-229. (2022)
- [21] Ahn, J., & Sura, S.: *The Effect of Information Quality on Social Networking Site (SNS)-Based Commerce: From the Perspective of Malaysian SNS Users. Journal of Organizational and End User Computing (JOEUC)*, 32(1), 1-18. (2020)