

# Emerging Technologies in Finance Inclusion: A Theoretical Framework and Research Directions

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## Abstract

The new accounting in the future should be an innovative and disruptive accounting system that integrates various emerging technologies, such as blockchain, cloud computing, data analytics, AI (artificial intelligence), and IoT (Internet of Things). Not just technology adoption and adaption, but more importantly, emerging technologies make up for the deficiencies of accounting systems, thereby making accounting more practical, precise, and valuable. Emerging technologies could play important roles in accounting, not just upgrading the systems but transforming the conventional approaches to new procedures. In the era of digital economy, this study attempts to explore new accounting mechanisms from emerging technologies' view and to depict a potential picture of future accounting systems. This research is one of the foundational papers that describe the future ecology of accounting system.

**Keywords:** Accounting information systems, emerging technology, digital transformation

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## 1. Introduction

Digital technology and Industry 4.0 give birth to digital economy. Informatization and industrialization are being realized through implementing emerging technologies, such as blockchain, cloud computing, data analytics, AI (artificial intelligence), and IoT (Internet of Things). An accounting system could demonstrate the digitalization process and status quo of economics. Double-entry bookkeeping originated in Italy from the 12th to the 15th century. It established a financial reporting system, maintained stability for a long time, controlled the process of value appreciation, and reflected the actual situation of business in the unique term to accounting. Accounting has the characteristics of responding to and adapting to changes in the economic environment, and digital environment has promoted the integration and development of accounting and emerging technologies (Beaver, 1998; Lu, 2017 & 2021b).

Due to the backward process of bookkeeping, traditional accounting cannot reasonably apply important accounting principles, resulting in low quality of information and insufficient disclosure of non-financial information. It also has been widely questioned and criticized as forward-looking data and core resources and assets not being reflected. The two major functions of accounting are reflecting and controlling, and the means to achieve these functions is accounting information systems. Accounting performs delayed, vague, one-sided and ineffective information, due to it fails to obtain information in a timely, accurate, comprehensive, and effective manner. In the face of complex market environment, stakeholders such as institutions, investors, creditors and regulators are eager to obtain real-time, complete and forward-looking information. It is potential to employ emerging technologies to transform traditional accounting systems and to enhance value creation (Sinha, 2020; Petkov, 2020).

In the research, we present a new mode of accounting information system that is integrated with emerging technologies. The characteristics of the new accounting model are as follows:

(1) The measurement is diversified, integrating monetary and non-monetary measures to reflect value information and non-financial information. The connotation of accounting reflection has been expanded unimaginably, not only presenting the results of transactions and operations, but reproducing and transforming the processes. The function of accounting will not stay on reflection and control, and new functions such as prevention, forecasting, and decision support will inevitably appear (Mancini, Lombardi & Tavana, 2021; Zhao, Zhang & Zhao, 2022).

(2) The integration of accounting and business. The process of business occurrence is presented in real-time in scenarios, which will be widely used. Accounting will dynamically present the entire process of business occurrence and development, reveal the value creation process and mechanism, explore the risk source and dynamic deduction process, and conduct a new business-oriented and demand-oriented accounting (Bonsón & Bednárová, 2019).

(3) Accurate, intuitive, and diverse accounting disclosure procedures. It is no longer necessary to distinguish between general information and special information, and users can obtain insights according to their needs. Accounting information will be presented in a visual form to enhance the user's information. Users can also view information based on topics such as supply chain, value chain, and customer relationship management, thematic information based on risk status, financial status, and future development trends, as well as segmented information such as regions, industries, and customer purchasing behaviors (Zhang, Pourroostaei Ardakani & Han, 2021).

In terms of status of accounting information, many large multinational companies, such as Google, Alibaba, Amazon, Tencent, Microsoft, etc., have formed the ability to provide global decision-making services and system solutions. In recent years, a prominent application area of emerging technologies is the construction of technology platforms to integrate accounting information and provide financial services (Peng & Chang, 2019; Petkov, 2020).

In this study, the four problems are addressed and explained:

(i) The current status and research of technologies-embedded accounting system. Such as blockchain-based, cloud-embedded, AI-oriented, etc.

(ii) We address and interpret the major emerging technologies that are potential to apply to accounting system.

(iii) We propose a new mode of accounting system and framework, with various emerging technologies, to resolve issues of accuracy, transparency, security, operability, stability, and interoperability.

(iv) The new generation of accounting system consists of two major parts: to be digital and digitize accounting system. In the discussion session, we illustrate and clarify both aspects.

The paper is structured as follows: Section II presents the extant studies of the new accounting system. Sections III list and explain popular emerging technologies for new accounting systems. Section IV proposes a framework for a new mode of accounting system. Section V discusses potential directions, including digital and digitized accounting systems. Section VI concludes the paper.

## 2. Literature Review

A new mode of accounting system that integrates potential technologies that are useful to accounting system (Bonsón & Bednárová, 2019). On the basis of literature analysis, a study proposed a framework that technologies (AI, IoT, and Blockchain) have potential to explore different directions to accounting systems (Sinha, 2020). In this section, we will address the extant literature of accounting systems from angles of different technologies, including blockchain, cloud computing, data analytics, AI (artificial intelligence), and IoT (Internet of Things).

### 2.1 Blockchain and Accounting

Although blockchain is still on the early stage of application, researchers and practitioners show much enthusiasm to the technology. Due to features of blockchain, e.g., distributed ledger, immutability, transparency, and security, accounting system will be influenced and changed deeply. Meanwhile, blockchain-brought issues, such as energy consumption and technological limitations, will be resolved in appropriate ways (Dai &

Vasarhelyi, 2017; Yu, Lin, & Tang, 2018; Lu, 2019a; Pimentel & Boulianne, 2020). Studies try to investigate and interpret how blockchain is integrated with accounting and how blockchain deals with accounting procedures, by analyzing the extant literature. The bibliographic analysis illustrates articles of various resources by multiple methodologies (Lu, 2018; Secinaro, et al., 2021; Bellucci, Bianchi, & Manetti, 2022).

Blockchain technology can deal with accounting data and transaction processes. Blockchain technology can also resolve problems from accounting payable and receivable, double-entry accounting and triple-entry accounting. For a comprehensive accounting system, blockchain is the only technology that is employed. Other technologies are AI, IoT, cloud computing, etc. (McCallig, Robb, & Rohde, 2019, Cai, 2021). The distributed ledger technology offers better solutions to data processing, for example, recording, analyzing, and storing. The major functions of blockchain that are implemented in the real world are scalability, flexibility, cybersecurity, immutability, traceability, etc. Blockchain-based platforms include three basic categorizations, private (permissioned), public (permissionless), and consortium (hybrid) systems. Different platforms are utilized based on requirements and objectives (Stein Smith, 2018; Tan & Low, 2019; Chen, et al., 2022).

Many studies conduct empirical research to seek connections between accounting systems, users' recognition, and implementing blockchain technology. For instance, UTAUT (the Unified Theory of Acceptance and Use of Technology) is used to verify factors that impact the integration of blockchain and accounting system (Abdennadher, et al., 2021; Afifa, et al., 2022). For transaction and auditing, permissioned and permissionless blockchain systems appear to be different. It is necessary to seek a balance point, which will take effect on accounting system reliably and secured (Liu, et al., 2019; Appelbaum & Nehmer, 2020; Lu, 2021a). Professionals and practitioners will be benefited smoothly if blockchain's drawbacks can be compensated and end-users achieve higher level of recognition of blockchain (Schmitz & Leoni, 2019; Karajovic, Kim, & Laskowski, 2019; Smith & Castonguay, 2020).

## **2.2 Cloud Computing and Accounting**

Integrated with cloud computing, accounting system has been promoted to high levels of (operation and management) cost reduction, data sharing and analytics, safety and integrity, and accessibility and interoperability (Dimitriu & Matei, 2014). Informatization is an important component for intelligent accounting systems, and cloud platform enhances informatization to be systematical and effective (Warren Jr, Moffitt, & Byrnes, 2015; Xu, 2020).

In addition, cloud computing is flexible and cost-saving. Hence, SMEs (Small and medium sized enterprises) have a great opportunity to implement cloud-oriented business in competitive markets. Empirically proved, cloud computing is a useful tool between accounting system and decision making (Maelah, Al Lami, & Ghassan, 2019). Cloud computing can benefit stakeholders and accounting, but challenges also exist. For instance, to what extent auditors disclose material weakness is a real issue when cloud services are more employed in companies (Smith, Zhang, & Kipp, 2019).

## **2.3 Data Analytics and Accounting**

Data analytics tools and techniques are critical to managing accounting system, decision making, and value creation (Schneider, et al., 2015; Chen, et al., 2016; Xu & Zhou, 2021). Data

analytics also will bring consequences to accounting professions and systems. It is still controversial whether data analytics replaces or complements accounting system (Richins, et al., 2017; Richardson & Watson, 2021). Various algorithms and models of data analytics acquire a more-advanced platform to utilize, and cloud computing is one of the advanced platforms (Ting & Liu, 2020).

## 2.4 AI and Accounting

It is argued that AI is potential to take over accounting activities sooner or later. AI and the relevant techniques are good mechanisms to improve the performance of accounting management system for evaluation and estimation of operational processes in companies (Lu, 2019b; Chen, 2021). AI-based machine learning is supposed to process data analytics and knowledge recognition automatically throughout a cloud -based platform (Marshall & Lambert, 2018). AI-embedded solutions and systems are clear way that both big companies and SMEs can follow for business successes and development (Mihai & Duțescu, 2022). AI-related solutions sometime appear to bring issues, such as ethics and sustainability. How to balance advantages and disadvantages in managerial accounting is critical (Vărzaru, 2022).

Based on the extant literature, current research of technology-oriented accounting systems focuses on blockchain and cloud computing, since the unique features and functions of the two technologies, respectively. Specifically, blockchain technology provision decentralization, transparency, security, immutability, and cost-saving; cloud computing mainly conducts an integrated and interoperated platform of data analytics and storage. It can be seen that AI, IoT, and other technologies will enhance the performance of accounting systems in different aspects, in the near future. Accounting systems cannot be intelligent without the implementation of AI and IoT (Ma & Zhang, 2020).

Meanwhile, to mitigate the side effects and to avoid potential risks form emerging technologies are tasks that are difficult to fulfill. Overall, digitization and transformation of accounting system is the trend and valuable. Most related studies pay attention to one type of technology and the potential to influence the accounting system. In our study, we propose a new mode of accounting system, ET-based (emerging technologies) accounting system, which is an evolutionary and creative thinking of accounting.

## III. Potential Emerging Technologies in Accounting System

Emerging technologies revolutionize the world in many aspects, including accounting information systems. Accounting information system is a standardized data-oriented and data-analyzed system. Emerging technologies, such as blockchain, cloud computing, data analytics, AI (artificial intelligence), and IoT (Internet of Things), are potential to improve the overall performance of accounting system. For example, precise and comprehensive data-related activities can be dealt with in mining and analytics. Blockchain is a platform to provide security, privacy, and data management. Cloud computing is a viable and advanced storage strategy. Accounting implementations can be achieved through AI-relevant techniques instead of conventional methods and human manual operation. IoT conducts a network that connects components and transmits data and values.

### 3.1 Blockchain

As thousands of years have passed, industry disrupting innovations have continued to alter how business is conducted from paper to tablets and from computer to clouds. The accounting profession has continued to stand the test of time to protect investors of a company that there is no possible way to assess all information of the company that goes into the financial statements. An emerging technology called blockchain is an alternative way to resolve the issues potentially (Lu, 2018).

Blockchain operates under a similar premise. When data is being added to the blockchain, a network of miners is working to solve a complex rigorous equation to encrypt data onto the chain. The entire network works to solve this equation and after solving it moves to the next as data is added onto the blockchain. It can then be aggregated to form a traceable ledger that is autonomous, unchangeable and practically impenetrable from cyber threats. When a smart contract is used in conjunction with blockchain, the result is an agreement in encode that only executes when the terms of the contract have been met. After execution, the contract is then recorded on the blockchain without unnecessary human intervention once the contract is set in motion (Lu, 2019a).

What if blockchain technology could be used to help maintain accountability for the financial information that companies are providing to investors. Many companies encountered non-incidental fraud or losses, which stemmed from management decisions to fraudulently manipulate the financial information being provided to investors. The use of blockchain technology can help companies improve the integrity of their financial information as seen in some of the largest scandals when accuracy dwindles investor confidence is lost. It is essential to have increased monitoring and transparency over how companies adapt generally accepted accounting principles (Lu, 2021).

Blockchain technology has the potential to revolutionize how companies collect data and present their financial information. To safeguard investor interests, the accounting professions adapt to an ever-changing world of goods and services. Consider the use of blockchain technology to help recognize the revenue from goods or services, only after the goods or services provided would a smart contract trigger the recognition of that revenue onto the blockchain ledger. This can be done by sampling the data and verifying that sample by sending letters to customers to confirm their balances among other methods of accounting (Chen, et al., 2022).

Blockchain technology can shift an auditor's rule from utilizing a reactive approach to a proactive methodology. Rather than spending time verifying transactions, an auditor would discuss management judgements before it is even written into a smart contract. Management would first discuss their judgements and estimates with auditors to ensure that they completely adhere to generally accepted accounting principles. Only after an auditor's sign-off with the obligation or their judgements be written into a smart contract to execute blanket treatment across all transactions without unnecessary human intervention (Dai & Vasarhelyi, 2017).



### 3.2 Cloud Computing

Cloud computing provides computing services that can be dynamically expanded on demand through the network. It is a service related to information technology, software, and the Internet. Cloud computing provides available, convenient, on-demand network access to a shared pool of provisioned, configurable resources (Xu, 2020).

Cloud computing has developed faster, and the corresponding application scope has become wider. The development of cloud computing provides a certain data processing platform and technical support. Cloud computing provides distributed computing, elastic expansion, cheap storage space, and computing resources, which are all very important components in the development of big data technology. In addition, the IT resources of cloud computing are rich and widely distributed. With the continuous development and improvement of cloud computing and the maturity of platforms, the level of data processing will also be significantly improved (Smith, Zhang, & Kipp, 2019).

For example, in the past, a company had to build an accounting information system to support its business. It needs to build its own computer workstation, buy servers, build systems, develop various applications, and set up special personnel for maintenance. First, the one-time investment cost is high; second, it is difficult to rapidly expand the production capacity when the company's business expands; third, the utilization efficiency of software and hardware resources is low; fourth, maintenance is troublesome. Cloud computing changes implementations of accounting data analysis in an efficient manner (Dimitriu, & Matei, 2014).

### 3.3 Data Analytics

Data analytics refers to the analysis of large-scale data. Big data can be summed up in four Vs: Volume, Velocity, Variety, and Value. The value of big data has gradually become the focus of people's profit in various data-related industries, such as data mining, data warehouse, data security, data analysis, and other applications (Chen, et al., 2016). The four most commonly used data analysis methods are: descriptive analysis, diagnostic analysis, predictive analysis and prescriptive analysis. (Schneider, et al., 2015; Xu & Zhou, 2021).

Data analytics collects data in multiple dimensions and integrates information systems with powerful data processing functions. Taking inventory management as an example, if the total inventory rises sharply at a certain time, resulting in a large backlog of inventory, managers can easily capture descriptive analysis that reflects inventory in a timely manner. Managers want to know the specific reasons for the significant increase in inventory. It needs the assistants of data analytics on market conditions, company inventory management and production management, to conduct a diagnostic analysis of market share, inventory structure and product process. Managers are aware of raw materials that companies are purchasing for strategic reasons. Further, managers may also need information systems to provide valuable predictive analytics. Through a forecasting model, the information system can predict the trend of inventory changes in the future. In the face of the increase in inventory levels, it is necessary to formulate reasonable countermeasures. With the help of prescriptive analysis, managers can filter out the set of strategies under various constraints and adopt a better solution (Ting & Liu, 2020).

### 3.4 AI

AI is human-like behavior and thinking, and rational recognition and reaction. The foundations of AI are a combination of philosophy, mathematics, economics, neuroscience, psychology, computer engineering, cybernetics, and linguistics. Artificial intelligence includes four branches. 1. Pattern recognition, 2. Machine learning, 3. Data mining, and 4. Intelligent algorithm (Lu, 2019b; Zhang & Lu, 2021).

The application of AI in the field of accounting generally involves both accounting and financial analysis. Pattern recognition is used in accounting through identification and classification of huge and complex data of economic transactions and events, to form valuable decision support information system. Pattern recognition classifies data and improves the quality of financial analysis. For example, the recognition of graphics is employed in real time and pushes relevant information to users in a timely and accurate manner. Machine learning can collect, classify and analyze data and automate accounting operations, including data processing, analysis and utilization of historical financial information, and acquisition and analysis of forward-looking data (Chen, 2021).

Data mining techniques are the use of algorithmic searches to mine useful accounting information. Stock investment decision analysis is a typical example of the use of data mining techniques. By constructing and using a time series analysis model, the substantive information related to stock investment decisions is mined from databases to ensure the correctness of stock investment decisions. Intelligent algorithms can simulate accountants for information processing and analysis. Taking cost accounting as an example, enterprises with diversified product varieties have to deal with cost data involving tens of millions of materials, labor and manufacturing expenses. Intelligent algorithms can quickly and accurately process cost data, and aggregate and allocate according to different product categories to ensure the accuracy and timeliness of product cost (Mihai & Duțescu, 2022).

### 3.5 IoT

The Internet of Things (IoT) is information technology and will change industrial manufacturing, agricultural production and people's daily lives. Also, IoT can improve economic efficiency and save costs; it can provide technological impetus for global economic recovery. In the IoT era, reinforced concrete and cables will be integrated with chips and broadband into a unified infrastructure. In this sense, infrastructure is more like a new construction site on which the world operates. These include economic management, production and operation, social management and even personal life (Lu & Xu, 2018; Xu, Lu, & Li, 2021).

IoT uses sensors, chips, and devices that transmit data to realize automatic transaction processing of materials, commodities or fixed assets embedded in IT elements and real-time monitoring of physical locations. For example, when it comes to asset tracking, IoT technology can confirm the real-time location of fixed assets, vehicles, and inventory. In addition, IoT technology can monitor and record slow-moving inventory items and check their values, thereby improving asset liquidity. In addition, IoT technology enables the effective management of fixed assets (Ma & Zhang, 2020; Xu, Lu, & Li, 2021).



#### 4. ET-based Accounting System

Traditional accounting relies on four basic assumptions: economic entity, monetary unity, accounting periodicity, and going concern to establish recognition of managers' fiduciary responsibilities and user decisions system. However, due to the impact of complex and dynamic business environment, the accounting system appears to be outdated, incomplete, insufficient, and inapplicable. With implementation of emerging technologies, it is durable to reconstruct the value with new means and redesign a new mode of accounting, ET-based accounting system. The detailed procedures are transaction and events, recognition, measurement, recording, empowerment, and report (Figure 1).

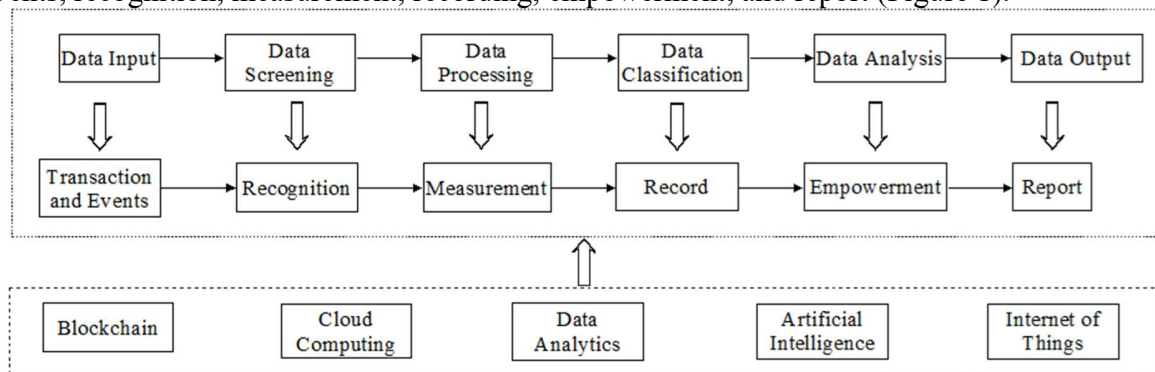


Figure 1. ET-based Accounting Information System

#### Proposition:

The integration of emerging technologies has the potential to increase values created in accounting information systems.

In our study, we take the Inventory-Transaction Model to interpret the value creation throughout the entire system. Typically, a manufacturing company's inventory consists of raw materials, work-in-progress, and finished goods. Inventory measurement and cost flow can be divided into three parts: raw material procurement, goods producing and product sales. The following is the original model of inventory measurement (Model 1).

$$Inventory_{ot} + Inventory_{it} - Inventory_{dt} = Inventory_{et} \pm Inventory_{beidt} \quad (1)$$

Specifically,

$Inventory_{ot}$  represents opening inventory in the t period,

$Inventory_{it}$  represents increased inventory in the t period,

$Inventory_{dt}$  represents decreased inventory in the t period,

$Inventory_{et}$  represents ending inventory in the t period,

$Inventory_{beidt}$  represents balance of ending inventory depreciation reserves in the t period.

Model (1) is applicable to each accounting step and reflects the continuous change of inventory cost through the inventory purchases and self-production, consumption and sales, and inventory in stock. GAAP recognizes that the cost of inventory delivery can be measured according to the first-in, first-out (FIFO), the last-in, first-out, and the weighted

average cost. The lower of cost and net realizable value or the lower of cost and market price is used to measure inventory impairment.

Based on Model 1, we have Model 2,

$$Inventory_{ot} + Inventory_{it} = Inventory_{dt} + Inventory_{et} \pm Inventory_{beidt} \quad (2)$$

Many scholars believe that managers will choose the inventory measurement that can most increase personal interests. According to Model 2, without considering the inventory impairment, the left side of the equation ( $Inventory_{ot} + Inventory_{it}$ ) represents the total inventory in the current period, and the right side ( $Inventory_{dt} + Inventory_{et} \pm Inventory_{beidt}$ ) represents the appropriate allocation of the total inventory in the current period between the issued inventory and the ending inventory. Thus, when the enterprise performance is not good, the managers will be more likely choose to reduce the cost of carrying forward inventory and increase the ending inventory. This will lead to overestimating the ending inventory and exaggerating the profits.

Let  $x$  denote the integration of emerging technologies and accounting systems.  $f(x)$  represents the value-added by the integration of emerging technologies and accounting systems (Model 3).  $f(x)$  mainly covers: (1) forward-looking effect (FLE), (2) time-manner effect (TME), (3) comprehensive effect (CE), (4) accurate effect (AE), (5) objective effect (OE), and (6) sufficient effect (SE).  $A$  is a constant coefficient.

$$f(x) = A(x), \quad (3)$$

$x$  may be one of the six effects, such as FLE, TME, CE, AE, OE, SE

The integration of emerging technologies will reverse unfavorable situations of traditional accounting, aiming at improving the quality of accounting information and adding values to stakeholders. The six types of values associated with different emerging technologies are reflected through the entire accounting systems (Table 1).

**Table1. The Summary of Value Creation**

Accounting Procedure (Value-Added)	RQ (Research Question)	Emerging Technologies
Transaction and Events (FLE)	Emerging technologies play a forward-looking role in accounting information systems.	Cloud computing, blockchain, AI
Recognition (TME)	Emerging technologies play a timely-manner role in accounting decision-making efficiency.	AI IoT
Measurement (CE)	Emerging technologies play a comprehensive role in accounting information systems.	Data analytics cloud computing
Recording (AE)	Emerging technologies play a role of accuracy in accounting decision-making.	AI blockchain
Empowerment (OE)	Emerging technologies play an objective role in accounting information systems.	Data analytics AI
Report (SE)	Emerging technologies play a sufficient role in accounting information systems.	IoT blockchain

#### 4.1 Transaction and Events

Transactions and events are the starting point of the accounting system. Transactions and events together constitute the operation of the company and determine the implementation of the business. Transactions and events are encoded in a multi-dimensional appearance of accounting information from the occurrence, through which development can be tracked in real time. The powerful data storage, integration and deployment capabilities of cloud computing technology can help accountants analyze potential business impacts, compliance, risks and future trends rather than a single transaction or event. To potential investors in the capital market, ET-based accounting system can analyze the consequences of new product development and investment of listed companies, judge the impact of private placements by market regulators, estimate the impact of private placements on listed companies by creditors and their stance on corporate bond investment (Beaver, 1998; Peng & Chang, 2019).

Blockchain is characterized by decentralization and distributed ledger. It can ensure the authenticity and reliability of data obtained from the cloud platform and recognize the key components by AI-related algorithms when transactions and events occur. ET-based accounting system provides a full-scene map for observing transactions and events, which is reflected in multi-dimensional, real-time accounting information. It greatly enriches and expands the value of accounting information systems (Petkov, 2020; Zhao, Zhang, & Zhao, 2022).  $f(x)$  acts on Model 1, and the real-time inventory is the result of considering various factors. In this way, the information on which the decision is made is more forward-looking.

RQ 1. Emerging technologies play a forward-looking role in accounting information systems. It can be illustrated as follows:

$$Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(FLE)} Inventory_{et} \pm \frac{Inventory_{beidt} + \text{Value-Added (FLE)}}{\quad} \quad (4)$$

#### 4.2 Recognition

Recognition is the first step in transmitting transactions and events into the accounting elements that make up the project. At this stage, after screening, analyzing, and classification of business activities, the uncertainty of economic business is transformed into the certainty of accounting language. The Statements of Financial Accounting Concepts issued by the US FASB specify four criteria for recognition: definition, measurability, relevance, and reliability. These standards provide a guiding framework for analyzing the role of emerging technologies in changing the function of accounting recognition.

ET-based accounting systems can help establish accounting systems to guide and manage operational processes. In the raw material procurement activities of manufacturing, using the QR code to confirm the materials and record them into the corresponding accounts. AI and IoT provide guidance for the confirmation of business and ensure that accounting information better meets the requirements of accounting standards. For a project with a long construction period, an IoT system can provide continuous and dynamical implementation of the entire process of project, by optimizing the accounting information process (Dai & Vasarhelyi, 2017; Mancini, Lombardi, & Tavana, 2021).

For long-forgotten off-balance sheet items that participate in or affect the company's value creation, ET-based accounting system can reflect the composition, function, and development trend of these items by amplifying the accounting confirmation conditions. It reverses the incomplete and insufficient confirmation mode of traditional accounting to a certain extent. For example, the importance of raw material availability and its impact on factors such as production, market share, customer stickiness, competitor strategies, substitutes, could change in real time. (Ma & Zhang, 2020). Meanwhile, some unrecognized important items, such as product sales, human assets, management advantages and even the physical health of the CEO, will also be presented in an appropriate manner (Gyongyosi & Imre, 2019; Elshaari, et al., 2020).

Reflecting in the inventory model,  $f(x)$  acts on Model 1, which can dynamically reflect inventory revenue, shipment and information in real time. It is potential to grasp real-time information of inventory revenue and expenditure to improve decision-making efficiency.

RQ 2. Emerging technologies play a timely-manner role in accounting decision-making. It can be illustrated as follows:

$$\frac{Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(TME)} Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (TME)}} \quad (5)$$

### 4.3 Measurement

Measurement is the recognition of the recorded value of recognized transactions and events in terms of currency. The Statements of Financial Accounting Concepts lists five measurement attributes used in Generally Accepted Accounting Principles (GAAP): historical cost, net realizable value, current costs, present value, and fair value. For instance, land, as historical cost, will be treated as receivables of net realizable value and investments of fair value. For a long time, the problem to be solved by accounting value measurement attributes is to strike a balance between reliability and relevance. This situation pushes the historical cost principle and the fair value principle to represent reliability and relevance, respectively (Liu, Wu, & Xu, 2019; Mihai & Duțescu, 2022).

ET-based accounting systems have a unique role in responding to changes in the value of accounting, thereby improving the quality of accounting information to a large extent. Data analysis and cloud computing provide sufficient information to ensure the accuracy, rationality and validity of accounting measurement. For example, for fair value, the basis for the fair value measurement of the underlying asset is derived from data that may be referenced by market participants within the simulation framework. For important transactions and events, the accounting can list the measurement results that are biased towards reliability or relevance at the same time, and users can clearly see the difference between the two and make judgments (Schneider, et al., 2015; Chen, 2021).

With the application of IoT technology, structured, unstructured and semi-structured data are collected and classified from different dimensions for accounting measurement. Each measurement attribute around value measurement is to label on transactions and events. Through these tags, users can reproduce business scenarios, and the accounting reflection is more comprehensive, real and vivid. Multi-dimensional measurement also lays the foundation for subsequent empowerment and report (Ma & Zhang, 2020; Afifa, et al., 2022). These changes are

reflected in the inventory model, and  $f(x)$  acts on Model 1, which can effectively avoid inventory omissions, timely discover and evaluate inventory value losses, and appropriately withdraw inventory depreciation reserves.

RQ 3. Emerging technologies play a comprehensive role in accounting information systems. It can be illustrated as follows:

$$\frac{Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(CE)} Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (CE)}} \quad (6)$$

#### 4.4 Recording

Recording is the process of recording recognized and measured transactions and events. Recording enables recognition and measurement on the one hand, and justification on the other. Accounting is a step-by-step process, from manual bookkeeping to intelligent accounting. In this process, manual bookkeeping will inevitably be replaced (Smith, Zhang, & Kipp, 2019; Zhao, Zhang, & Zhao, 2022).

AI technology is connected to the accounting information system, and the system automatically identifies bills, generates accounting vouchers, records detailed accounts, and generates general ledgers and reports. The system records and verify each transaction in chronological order. The application of blockchain technology greatly ensures the authenticity and accuracy of transaction data information. Accounting is embedded in business processes, and scenario-based accounting that reflects business scenarios in practice will be highly valued and implemented (Zhang & Lu, 2021; Zhang, Pourroostaei, Ardakani, & Han, 2021).

Accounting records are the process of turning abstract businesses into concrete events, and blockchain extends, enrich and deepen this process. What used to be a routine of aggregated records of multiple transactions has been transformed into an independent real-time record based on the amount of a single transaction. Records are clearer, more detailed and effective. In the past, it was a separate record based on the principle of double-entry bookkeeping, but now it is a series of records that link different accounting entities and businesses. Such accounting records are multi-dimensional, cross-time, and combined with business, clearly and truly display business scenarios, and provide valuable information (Xu & Zhou, 2021).

It is more appropriate to allocate the total inventory of the current period between the inventory issued in the current period and the ending inventory. These changes are reflected in the inventory model,  $f(x)$  acts on Model 1 and Model 2. The inventory income, expenditure and inventory are more accurate.

RQ 4. Emerging technologies play a role of accuracy in accounting decision-making. It can be illustrated as follows:

$$\frac{Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(AE)} Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (AE)}} \quad (7)$$

$$\frac{Inventory_{ot} + Inventory_{it} \xrightarrow{f(AE)} Inventory_{dt} + Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (AE)}} \quad (8)$$

#### 4.5 Empowerment

Empowerment is the application of emerging technologies, including data analytics and AI. There exists a strong link between delegation and reporting. A high level of reporting is both a result of and an important factor in increasing the level of empowerment (Beaver, 1998). ET-based accounting system pushes the single-currency measurement and accounting to be structured, semi-structured, and hybrid data as intertwined, multi-dimensional, and multi-perspective. The whole process presents business scenarios, reduces information asymmetry, and improves the decision-making quality of information end-users. This helps lift the management level and the efficiency of market resource allocation (Peng & Chang, 2019; Xu & Zhou, 2021).

For example, for complex mergers and acquisitions, the new accounting system provides information on core asset quality assessments, future market risks, and expected returns. In the process of generating accounting information, there are two situations: accounting and business integration, employee participation. The professional level of accountants and the accounting and financial cognition of general employees have been improved to varying degrees at different levels, which invisibly increases the human resources of the company. From the perspectives of investors, creditors, government agencies and other investors and regulators, accounting information can better reflect their interests, their attitudes toward the company's important business activities, and regulatory concerns, so as to better establish a close relationship communication mechanism to maintain a good relationship (Dai & Vasarhelyi, 2017; Smith & Castonguay, 2020).

Through sufficient information disclosure, coupled with the effective use of data analysis and AI, judgment and estimation of accountants should be reduced as much as possible, so as to improve the quality of accounting information. These changes are reflected in the inventory model,  $f(x)$  acts on Model 1 and Model 2, users can understand the inventory circulation process more objectively.

RQ 5. Emerging technologies play an objective role in accounting information systems. This phenomenon can be illustrated as follows:

$$\frac{Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(OE)} Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (OE)}} \quad (9)$$

$$\frac{Inventory_{ot} + Inventory_{it} \xrightarrow{f(OE)} Inventory_{dt} + Inventory_{et} \pm}{Inventory_{beidt} + \text{Value-Added (OE)}} \quad (10)$$

#### 4.6 Report

Reporting is the transfer of processed accounting information to internal and external users in an appropriate manner. The introduction of emerging technologies has revolutionized the content and format of reports. In theory, technical means can display the business processes,



key controls, important decisions, operating environment conditions, supply chain stability, and financial and operating results of an enterprise in real-time. The application of emerging technologies runs through the entire process of data and information acquisition, processing and reporting (Richins, et al., 2017; Stein Smith, 2018).

In terms of content, it involves the entire process from the occurrence of the aforementioned transactions and events to reporting, and is divided into input, processing and output links. In the data entry, the IoT system ensures that data can be achieved to be standardization and interoperability. Blockchain technology guarantees authenticity, reliability and usefulness of data processing. In the information output link, knowledge graph, neural network, virtual reality and other technologies are widely used to realize the personalization, visualization, real-time reports.

As a shareholder, on the basis of obtaining general reports, it is also necessary to obtain information such as company strategy, assets, management team, business risks, and future development. As a manager, except of obtaining general management accounting information such as budget execution, cost control, risk management, employee performance appraisal and company performance management, it is necessary to obtain major investment and financing activities, and the signing and performance of important contracts. In addition, non-financial information and forward-looking information that cannot be provided by traditional reports can also be fully reflected in the report. The new accounting report will describe the processes, results and key elements associated with corporate value (Warren Jr, Moffitt, & Byrnes, 2015).

In practice, the accounting policy of the company's inventory accounting report has a lot of flexibility. These changes are reflected in the inventory model,  $f(x)$  acts on Model 1 and Model 2, and users can obtain more sufficient information.

RQ 6. Emerging technologies play a sufficient role in accounting information systems. It can be illustrated as follows:

$$Inventory_{ot} + Inventory_{it} - Inventory_{dt} \xrightarrow{f(SE)} Inventory_{et} \pm Inventory_{beidt} + Value-Added (SE) \quad (11)$$

$$Inventory_{ot} + Inventory_{it} \xrightarrow{f(AE)} Inventory_{dt} + Inventory_{et} \pm Inventory_{beidt} + Value-Added (SE) \quad (12)$$

Reporting is a process of reflecting, controlling, evaluating, consulting and other accounting functions, and it is also a process in which accountants participate and create company value with the help of emerging technologies. Through full disclosure, accounting reduces the transaction cost of user information search, screening, analysis and utilization. Users can obtain the required information more conveniently and in a timely manner, establish and maintain the rapport between users and the company. Under the new reporting mode, users' perspectives and dimensions of a company have undergone tremendous changes, and they can judge the company's business behavior according to their own needs. Meanwhile, the long-term debate based on the rule-oriented and principle-oriented reporting modes will no longer be meaningful, the space for accounting professional judgment will be reduced, and the judgment of market will be expanded (Zhang, Pourroostaei Ardakani, & Han, 2021; Mihai & Duțescu, 2022).

## 5. Discussions and Future Directions

The rise of emerging technologies that integrate conventional mechanisms is potential to promote the development of the accounting system, made up for the shortcomings of traditional accounting and reporting models, and overcome problems such as lagging accounting information, limitations of a single currency, and outdated financial records. Moving from behind the scenes to the front desk, the new accounting mechanism integrating emerging technologies penetrates into value creation and accelerates accounting system to be digital and digitization.

### 5.1 Digital and Intelligent Accounting System

For external reporting users, the new accounting model accurately and instantly reflects the logic and process of enterprise value creation. The information provided by the new accounting model provides sufficient support for external reporting users making investment decisions. Instead of seeing an outdated static sequence of numbers, users can gain real-time insights into digital business scenarios to judge overall business conditions and future prospects. External report users can judge the operation of an enterprise from a long-time span. The judgment is a comprehensive judgment based on the perspective of the internal and external business environment and the comprehensive resources of the enterprise (Zhang, Pourroostaei Ardakani, & Han, 2021.).

Facing the internal management decisions of enterprises, the new accounting model can provide the information required for a series of management activities, such as strategic planning, business process optimization, supply chain relationship maintenance, value chain creation, and employee performance management. Furthermore, management can gain a clear understanding of the internal and external environment, in which possible reactions and consequences stakeholders will have. Managers' decision-making and decision-making effectiveness will be significantly improved. The bounded rationality problem of managers will be alleviated, but concepts such as entrepreneurship need to be redefined. How to evaluate the contribution of accounting systems in management activities and even value creation will become a new research topic (Petkov, 2020).

### 5.2 Accounting System Digitalizing and Transforming

The new accounting model will promote the innovative development of accounting theory in many fields. For instance, the multi-dimensional measurement and recording of accounting challenges the monetary measurement assumptions of traditional accounting; the stakeholder-based accounting and reporting models are inconsistent with the accounting entity assumptions of traditional accounting; real-time accounting systems make accounting period assumptions meaningless; business scenarios and forward-looking information greatly expands the going concern assumption. In addition, the accounting function has changed from reflection and control to the diversification of content and form, and new functions such as prevention, forecasting and decision support, and stakeholder relationship maintenance are constantly emerging (Mancini, Lombardi, & Tavana, 2021; Zhao, Zhang, & Zhao, 2022).

The new accounting model has greatly improved the quality of accounting information. Scenario accounting can reproduce the specific scenes of business occurrences, and to a large extent eliminate false accounting information. Multi-dimensional measurement and recording increase the content of accounting information and broaden the scope of accounting system, such

as, providing personalized accounting information for different needs, reducing the risk of poor accounting information quality, and avoiding accountants' opportunistic behaviors, etc. The formulation of accounting standards will also undergo important changes, from how to avoid the subjective misconduct of accountants, to giving appropriate treatment methods for specific businesses (Sinha, 2020; Mancini, Lombardi, & Tavana, 2021).

The new accounting model has revolutionized the way accounting information is generated. The generation of accounting information products is a process based on business, service, and even a process of transforming business. This makes it easy to find features of new accounting models, like employee engagement accounting and situational accounting. The convergence of accounting and business also brings a lot of confusion and challenges. Where are the boundaries of accounting? (Peng & Chang, 2019; Zhao, Zhang, & Zhao, 2022).

## 6. Conclusion

Accounting is a discipline about classification and statistics of data, analytics, and decision making. Classification changes as user needs are changing. Accounting needs to cultivate information thinking, exploration, and processing to provide forward-looking information to clients. Accounting needs to use emerging technologies to achieve digitization, informatization, and intelligence. In an emerging technology environment, the accounting process is more dynamic and interoperable. In this study, we propose a new mode of accounting system that is integrated with emerging technologies. After several rounds of transformation and digitalization, the goal of value creation of accounting will be accomplished.

## Disclosure Statement

No potential conflict of interest was reported by the author(s).

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