

## Blockchain- The Transformation of Accounting

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### Abstract

The transformation of accounting has been done in line with the evolution of the mechanism of realization of mutual trust, agency theory and support for the Separate Entities and information asymmetry between stakeholders. Triple-entry Accounting, with the advent of blockchain, revolutionized the way financial events are recorded, controlled, reported and disclosed. The advent of blockchain creates new opportunities and challenges for real-time accounting and ongoing auditing.

This study examines the understanding of changes in accounting methods and processes with respect to the environment and advances in science and technology and represents a future in accounting. The aim of this study is to analyzing the evolution of accounting practices and systems, examines the theoretical development of the accounting system from single-entry to double-entry, then to triple-entry, and finally to accounting in blockchain. This article is presented with a descriptive approach, based on the methodology of documentary research and in the framework of library studies.

Results show accounting along with other sciences, is evolving from traditional approaches to modernism and postmodernism, and new technologies such as blockchain have revolutionized other processes and approaches to improve the quality characteristics and reduce the limitations of accounting. Increases the efficiency, effectiveness and cost-effectiveness of accounting for stakeholders.

### Keywords

Blockchain, Accounting, Single-entry bookkeeping, double-entry bookkeeping, Triple-entry accounting.

## 1. Introduction

In the last two decades, information technology has played an essential role in the development of the business world. It has shaped the structure, processes, and regulations of many businesses. For the accounting profession, this is no different. Accounting has been shaped by the emergence of computers and has been optimized through the development of accounting software (Gomaa; Boumediene; Gomaa and Farag, 2019). The way we transfer and share information with each other has been changed in an incredibly significant way due to the advent of the internet but this has not necessarily been very helpful when the aspect of value exchange arises (Chowdhury, 2021).

Bookkeeping as the base of financial reporting developed and transformed together with the economy or the way business entities operate (Gröblacher and Mizdraković, 2019). Double-entry bookkeeping (DEB) slowly displaced single-entry bookkeeping (SEB) over 800 years and is now used by all but the smallest firms (Basu and Waymire, 2020). The Double entry bookkeeping evolved around the 1300s AD in Italy and is still being used to this day. Every single stage of economy development affected the bookkeeping. For example, the use of the Internet and informatics changed the way business entities operate these days (Gröblacher and Mizdraković, 2019). Although double-entry accounting has been used for more than 600 years, today's era of disruptive technological change utilizing blockchain and FinTech has led to the emergence of another promising accounting method: triple-entry accounting (Weiyi Cai, 2021). The development of blockchain technology revamped one of the older accounting concepts – triple-entry bookkeeping system (Gröblacher and Mizdraković, 2019).

A study into triple-entry accounting as a potential means of reformation of accounting systems in the era of disruptive technological change is both timely and critically important. In a global blockchain survey based on more than 1,000 blockchain-savvy executives, Deloitte (2018) concluded that 'momentum is shifting from a focus on learning and exploring the

potential of the (blockchain) technology to identifying and building practical business applications." While the financial services sector is already leading the way, using blockchain to re-examine processes and functions that have remained static for decades, the accounting sector instead remains more reserved and is far behind in terms of blockchain exploration (Weiyi Cai, 2021).

Blockchain technology can create a platform for the organizations to disclose their information voluntarily in the short-run while it decreases errors in financial disclosure, enhances the quality of accounting information and reduce information redundancy in the long-run. A harmonized movement of accountants, auditors, regulatory authority and other relevant parties can extract the optimum benefits of blockchain technology in accounting ecosystem. (Chowdhury, 2021). However, one key reason for the lack of blockchain development in accounting is the knowledge gap between blockchain developers and accounting experts. On the one hand, accounting professionals and academic researchers lack adequate training on blockchain concepts and infrastructures, and hence do not possess sufficient knowledge and skills for effective engagement. On the other hand, for blockchain to transform business processes (including accounting), blockchain experts will need more support from the accounting profession and academia in terms of specific business and accounting knowledge. This paper tries to fill this gap. Limited to our knowledge, this is the first academic paper which provides a clear overview of triple-entry accounting with blockchain technology using illustrative cases. Technical discussions are avoided as much as possible because the main goal of this paper is to raise the level of general understanding and awareness of triple-entry accounting with blockchain. We aim to motivate more accounting researchers, practitioners, and regulators to become familiar with blockchain technology. We are hoping our paper can generate insights on the acceptance and use of this promising triple-entry accounting method to inspire more researchers to work in this area. (Weiyi Cai, 2021).

The purpose of this paper is to provide an analysis of changes in the accounting system that can have the main differences in the application and differences between one- and two-entry systems. Therefore, This research of analyze the evolution of the accounting practices starting with the single-entry accounting system, next the double-entry accounting system, up to the imminent future implementation that will involve the triple entry linked to the blockchain technology.

## **2. Literature Review**

Writing first appeared in Egypt around 3,400 BCE and in Mesopotamia near 3,100 BCE and progressed from pictographs to phonograms that were combined in hieroglyphic script. Like the Mesopotamian tokens, the oldest Egyptian records store data on village level taxes and arrears using single-entry bookkeeping (SEB) with classified accounts to track commodity totals. Scribes kept detailed inventory lists for the royal storehouses that collected in-kind (usually grain) taxes (Basu and Waymire, 2021).

The earliest known accounting artifacts are the baked clay tokens recording transactions from Mesopotamia (now Iraq) circa 8,000 BCE. The first tokens were simple shapes (e.g., spheres, cones, and disks) representing physical quantities of cultivated grain and abstract labor units, enabling agricultural cooperation. These records expanded planning horizons since farming takes months compared to the daily food-gathering plans of nomadic hunter-gatherers. Settling down let farmers amass property and livestock, and property claims likely led to a shift from sharing within the kin group to trade between individuals. A system of bullae or clay balls encasing tokens emerged to record the identities of transacting parties using personal seals, which enabled multi-period contracts where performance tracking mattered. These multi-period contracts sparked the running records that we now call bookkeeping (Basu and Waymire, 2021). Therefore, Accountancy is one of the oldest professions in the world. However, ancient accounting never progressed beyond a single-entry accounting system in its thousands of years of existence. The single-entry accounting system involves

a one sided accounting entry for each transaction. Assets are entered and crossed off as they move in and out of the organization (and hence the accounting ledger) and the dollar amount is recorded once per transaction. Due to the single record and lack of crosschecking, this system is subject to serious limitations as errors cannot be detected and traced, providing ample opportunities for fraud (Weiyi Cai, 2021).

Nowadays accounting and traditional financial reporting face with inadequate analysis and misrepresentation of information among users. Thus, commercial markets and users of business information need arrangements and conditions to increase the transparency of the reporting process. Therefore, achieving a series of appropriate business reporting system to solve these problems is vital (Borhani et al, 2021).

## **3. Accounting transformation**

### **3.1. Single-Entry Accounting**

Single-entry accounting was invented around 5000 years ago in Babylon. This is the simplest and most basic form of accounting that exists (Gröndahl, 2020); because the shared entry is the sole reliable source of the transaction record, some call this methodology “single-entry bookkeeping” (Pacio 2018a, 2020). Grier (1932) describes the single-entry bookkeeping (SEB) records kept by an Egyptian farm manager, Zeno, in the third century BCE, for the owner, Apollonius. The 7,000-acre farm was organized as several functional units with each unit keeping daily records of inflows and outflows (in physical units only) for many different commodities like a modern perpetual inventory system. Numerals were recorded in a column at the far right, likely to ease computation of net balances that were transferred to monthly and annual accounts, like a petty cash system. Workers were paid in grains (a food allowance) that were tracked separately from money even in the annual accounts. This extensive system helped monitor the activities of thousands of workers, but it would have been very difficult to assess wealth changes by adding up different physical units. This is not an isolated

example. single-entry bookkeeping (SEB) systems date back thousands of years and were invented and used by many civilizations including Italy before Double-entry bookkeeping (DEB). Thus, large organizations existed and operated profitably using single-entry bookkeeping (SEB). However, a single-entry bookkeeping (SEB) system lets net assets and periodic profit be determined for an accounting period only if all units are converted into money terms (Basu and Waymire, 2021). The primary purpose of single-entry accounting was to record indebtedness, and account books consequently contained only accounts for persons. These accounts cannot readily be divided between debtors and creditors, since the colonial merchant bought from and sold to the same person. However, the nature of the goods generally permits accounts with customers to be distinguished from accounts with suppliers. Single-entry accounting satisfied the information needs of these colonial traders who had no need to report income and little use for the profit calculations permitted by double-entry methods (Schultz and Hollister, 2004).

In single-entry accounting one creates a list of assets or debts, and when an asset is bought or a debt is incurred, it is added to the list, and when the asset is sold, or the debt is paid, it is removed from the list. The single-entry system works well for the most basic needs; however, it is not sustainable for anything but the most basic lists. One of the issues with single entry, is that mistakes can easily occur without noticing them much later, as well as it being easy to manipulate. The reason for single-entry accounting being easy to both manipulate and why it is prone to errors is in its construction, it is a simple list. If liabilities and assets are being recorded on a simple list, there is no true verification that your assets and liabilities are in balance. When one is unsure whether the error is simply an error or, if it is a case of fraud, the situation can become quite severe. Single-entry accounting was used for around 4400 years, until the invention of double-entry accounting (Gröndahl, 2020). The single-entry bookkeeping is still used in practice (in the Republic of Serbia, for example, in very small - micro business entities). When using this

system the transaction will not necessarily be recorded on two accounts. It is still possible to calculate net result by observing corresponding account and transactions recorded on it, but the process is not inherently continuous as it is when double-entry bookkeeping is used (Gröblacher and Mizdraković, 2019).

The single-entry system depended on a simple asset list where asset was entered and as they moved in and out the company it was crossed off. The constraints of such a system are quite evident as errors are hardly noticeable, making deception easy. Double-entry system leaves a trace for every transaction as assets and liabilities had to be balanced and transactions had to be matched (Chowdhury, 2021). Therefore, Double-entry bookkeeping (DEB) slowly displaced single-entry bookkeeping (SEB) over 800 years and is now used by all but the smallest firms (Basu and Waymire, 2020).

### **3. 2. Double-Entry Accounting**

During the Renaissance period (late 1400s), merchants in Venice developed a new method for tracking their businesses transactions: double-entry accounting. In this recording system, each financial transaction requires at least two accounting entries (debit and credit) (Weiyi Cai, 2021). The double entry bookkeeping is one of the most significant breakthroughs in enterprise and commerce and double entry bookkeeping was a revolution to the single-entry system at the time of its conception (Chowdhury, 2021).

Double-entry accounting is said to have been invented in the 15th century by a Venetian friar by the name of Luca Pacioli. It is often speculated that the invention of double-entry accounting is what allowed the Venetian merchants to flourish in wealth and trading, as well as dominate in trading around the world. Eventually, double-entry accounting spread to the rest of the world and became predominate and only way of conducting accounting (Gröndahl, 2020). At the end of the 15th century commercial exchanges in the Mediterranean were very intense, particularly among the Italian maritime republics (including

Venice) and Muslim traders in the Middle East. It is also likely that the double-entry bookkeeping system described in the book by Luca Pacioli originated from the possible influence of the practice of Muslim accounting, practiced and implemented by the Venetians (Faccia and Roxana Mosteanu, 2019).

Lee (1973) pinpoints Double-entry bookkeeping's earliest known use to a Florentine bank in 1211 AD. These banks developed Double-entry bookkeeping (DEB) to create more reliable records for loans that could be audited better. Double-entry bookkeeping (DEB) was advantageous because it was easier to identify both the issuance of a loan and later repayments in a single account or via cross-references to multiple accounts. Thus, Double-entry bookkeeping (DEB) more accurately tracked account balances over multiple periods, which could be important in a legal dispute about the existence and current balance of a loan made by a banker. The courts came to recognize Double-entry bookkeeping (DEB) as the standard for bookkeeping, and this standard was incorporated into Italian law and gained broader acceptance as merchants adopted the method (Basu and Waymire, 2021).

Traditional accounting is based on a double-entry bookkeeping system, which is basically a credit-debit mechanism where any entry in an account requires an entry corresponding to a different account (Killi, 2019) (Oliveira Simoyama Et al, 2017). Whereas single-entry accounting included only personal accounts, double-entry accounting would also include accounts such as capital, cash, inventory, and profit and loss. Keeping separate accounts for various types of merchandise, on which profit or loss could in theory be computed, was one of the major characteristics of double-entry bookkeeping as developed in Europe (Schultz and Hollister, 2004). Double entry bookkeeping system provided a support for the calculation of return on capital or equity, which was the base of social capital. The logic behind this double-entry system is that every transaction has to be recorded on at least two accounts and that for every "debit" there must be a "credit". Previous means that every transaction has to be recorded at least twice in order to maintain the balance

sheet equation. Some of the transactions will affect only the structure of the assets of a business entity, for example realized payments from entity's buyers. Those transactions will not affect the amount of equity disclosed in the balance sheet. However, some other transactions will affect both assets and liabilities of an entity (Gröblacher and Mizdraković, 2019). Simply put, in double entry accounting a transaction generates both a debit and credit event. As an example, when someone purchases inventory or products there is a debit transaction in the inventory and a credit transaction in the bank account. The obvious benefit of double-entry accounting is that every transaction creates two events that cancel out each other. This in turn translates onto the balance sheet, where we can see whether our accounting balances. When credit and debit eliminate each other, the balance sheet will balance itself out. However, if for some reason there no longer is a balance, the error can be located quicker and easier, when compared to single entry accounting. In general errors are easier to find, and manipulation as well as fraud is harder to execute (Gröndahl, 2020).

Pacioli (1494/1914) explains how Double-entry bookkeeping is useful because accounts can separate out entries of "the highest importance in commerce" where "without entering the value of the things that you have traded, you could not, from your books and accounts, learn, except with great difficulty, what your profit or loss is." Thompson (1777) reinforces this when he notes that accounts categorized by product type are valuable because they provide more precise data on wealth changes: "Book-keeping by Double Entry.... is the art of keeping our accepts in such a manner, as will not only exhibit to us our net gain or loss upon the whole, but our particular gain or loss upon each article we deal in, by which we are instructed what branches to pursue, and which to decline; a piece of knowledge so very essential to every man in business, that without it a person can only be said to deal at random, or at best can be called but guessed work." (Basu and Waymire, 2021).

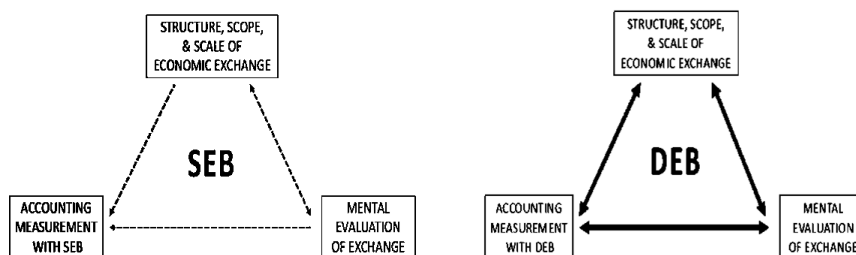


Figure 1: Co-Evolution of Accounting, Exchange & Exchange Evaluation with DEB vs. SEB (Basu and Waymire, 2021).

The double-entry bookkeeping system was a revolution compared to the single-entry system, and modern financial accounting has been based on this system for over 600 years. However, this double-entry booking system might be a firewall, but is not a moat against fraud. The balance check of double-entry cannot prevent cheating; even if the debits equal the credits, it is possible to do so in a false or misleading manner (Weiyi Cai, 2021). Many of the accounting scandals in the past decades have been caused indirectly and directly by some of the inadequacies and shortfalls of double-entry accounting. Most of these are related to fabricated verifications and transactions, which allows fraudulent transactions to slip through the internal controls. These inadequacies are often mitigated through audits that are conducted on a regular basis. These, however, are also prone to error, but it is better to have a control measure to try and prevent mistakes from occurring. Audits have not prevented large scale frauds from happening either. (Gröndahl, 2020). Nowadays double-entry bookkeeping it is not an absolute system, but it is logically extendible to triple-bookkeeping by including a set of force in its third axis (Faccia and Roxana Mosteanu, 2019).

### 3.3. Triple-Entry Accounting

The concept of triple entry accounting was first introduced by Ian Grigg (2005), and is not to be confused with another concept called momentum accounting which is also sometimes referred to as triple entry accounting. Triple entry accounting in the context of Ian Grigg, is accounting with three entries,

one extra in the addition to the traditional two (Gröndahl, 2020). In contrast to the classical double entry framework, Boyle (1997) and Grigg (2005) propose ledgers based on triple entries which provide the same reliable accounting between firms that double entry provides inside the firm (Oliveira Simoyama Et al, 2017). However, Triple-entry accounting has been discussed for years by both academics and professionals (Grigg 2005, 2011; Elias 2011; Tyra 2014; Kiviat 2015; Lazanis 2015). The primitive mechanism of transaction and business activity recording is single-entry bookkeeping, in which each transaction is only recorded in one account. Although such a mechanism is simple and efficient, it is fraught with a high risk of errors and fraud, since such issues are difficult to track and repair. To improve the accuracy of the bookkeeping system, traditional financial accounting is based on a double-entry system. This system enables rapid confirmation that the transaction has been correctly entered. The double-entry system can reduce the risk of human documentation error, such as accidental deletion of transactions, but it does not provide comprehensive assurance for companies' financial statements. Although auditors serve as third-party examiners who perform a series of tests on companies' accounting records and provide their opinions on the accuracy of the financial statements, improvements on the existing reporting and assurance system are still needed (Dai and A. Vasarhelyi, 2017).

The term 'triple-entry' was originally coined in 1986 by Yuji Ijiri, an accounting scholar. He proposed that in addition to the debit and credit entries, a third layer of entries called trebit should be included with a

new set of accounts to explain changes of income. The idea of such a ‘triple-entry bookkeeping’ system is to provide more momentum financial information to the organization, enabling better strategic decision-making (Weiyi Cai, 2021). However, the concept of triple entry accounting was first introduced by Ian Grigg (2005), and is not to be confused with another concept called momentum accounting which is also sometimes referred to as triple entry accounting. Triple entry accounting in the context of Ian Grigg, is accounting with three entries, one extra in the addition to the traditional two (Gröndahl, 2020). In contrast to the classical double entry framework, Boyle (1997) and Grigg (2005) propose ledgers based on triple entries which provide the same reliable accounting between firms that double entry provides inside the firm (Oliveira Simoyama Et al, 2017).

Ijiri designed a third level entry with a new set of trebit accounts to record the changes of momentum. Essentially, Yuji’s work extended the accounting equations from two layers to three layers, coinciding with the derivative/ integration concept in math as follows: Ijiri’s (1986) definition of triple-entry accounting focuses on how accounting information can facilitate the decision-making of internal management. The goal is to develop an advanced recording system

with more ‘momentum’ information, which will help managers to make better strategic decisions (Weiyi Cai, 2021). To illustrate, the development of the term triple entry bookkeeping, the table below indicates the year of the publication and the author that dealt with the term in their work. Subsequent to the table, a brief overview of the utilization and connotation of the term the authors Y. Ijiri and I. Griggcan may be found. While, E. Melse suggested several analyses of the application of Y. Ijiri’s framework for triple entry bookkeeping (Gröblacher and Mizdraković, 2019).

Triple-entry accounting expands the principle of double-entry accounting, by adding a third entry, “the receipt”. Triple-entry accounting, as its name suggests, has three entries: debit, credit and the receipt. These three entries are divided among three different parties, the payer, issuer and payee. The payer is the person initiating the payment, the issuer is the verifier and signer of the payment, and the payee is the person receiving the payment. A theoretical scenario where person A is going to pay person B, explains the potential system well: When person A pays person B, it passes through an intermediary called C. The intermediary C confirms that the payment has been received by B and produces a receipt of the transaction and sends it to both parties (Gröndahl, 2020).

**Table 1: the development of the term triple entry bookkeeping (Gröblacher and Mizdraković, 2019).**

Year of publication	Author	Title of the paper
1982	Y. Ijiri	Triple-Entry Bookkeeping and Momentum Income
1984	Y. Ijiri	Measurement of Wealth, Income and Force
1986	Y. Ijiri	A Framework for Triple-Entry Bookkeeping
2005	I. Grigg	Triple Entry Accounting
2008	E. Melse	Accounting in three dimensions: a case for momentum
2009		Emergence of blockchain technology
2010	E. Melse	Momentum Accounting for Trends: Relevance, Explanatory and Predictive Power of the Framework of Triple-Entry Bookkeeping and Momentum Accounting of Yuji Ijiri

In 2005, Ian Grigg, a financial cryptographer, wrote a working paper on his website titled ‘Triple-entry accounting’, giving this term a totally different meaning from Yuji Ijiri’s (1986) momentum accounting definition. Ian Grigg raised a new concept, ‘the receipt is the transaction’, wherein a digitally signed receipt backed up by financial cryptograph between two parties can be viewed by a shared third

entry to avoid transaction fraud and reduce redundancies in internal recording (Weiyi Cai, 2021). According to Ian Grigg (2005), transferring double entry accounting from paper to computers has not been as efficient as desired. Computerized accounting systems still rely on double-entry accounting that was meant to be done in paper form. Ian Grigg (2005) argues that we are not taking full advantage of

accounting on computers since the power given by computers is not leveraged. Instead of trying to adapt double-accounting entry for computers, we should focus on creating a new form of accounting that is meant for computer use and will use computer science to make it more secure and efficient (Gröndahl, 2020). Grigg argues that this model, so far a very trivial transaction indeed, gives too much centralized power to the issuer, who would be a powerful candidate for internal fraud. In order to reduce the issuer’s capacity to commit fraud, he proposes triple entry accounting with the very advantage that the three parties involved are guaranteed to hold exactly the same information, and no party may introduce unauthorized information (Oliveira Simoyama Et al, 2017).

Double-entry transaction set up jointly by three parties as a payer, a payee and a payee issuer, as is usually done by banks and their customers. The payer sends units of the beneficiary's money (for example, a check) and the issuer (the bank) is responsible for checking and signing the transaction, for transferring the money and issuing a receipt for both the payer and the payee to update their books. This model offers too much centralized power to the issuer, which would be strong candidate for internal fraud (Faccia and Roxana Mosteanu, 2019). Boyle (2003, see also Ibañez et al, 2020) explains that, in this context, bookkeeping becomes at least three-dimensional, because there is a need to represent transactions from the viewpoint of its two parties (even if stored in a viewpoint-independent manner): the sending side and the receiving side. Attempts at representing three dimensions in two dimensions will necessarily result in redundancy, that

is, recording the same transaction over and over (e.g. different, mirroring books for each party to the transaction). Historically, 3D accounting records were not available. At present, however, computer-based shared ledgers can maintain a shared record in a three-dimensional manner (Ibañez et al, 2021). Grigg’s proposal for triple entry is a single, cryptographically secured record called ‘the receipt’. The full evidentiary force of the receipt is ensured by the digital signatures of both the authorizing payer and the accepting issuer, thus ensuring that no party can successfully pass off an unauthorized transaction as valid. To Grigg, this reduces the problem of accounting to that of presence or otherwise of the receipt, which would then be guaranteed by sharing copies of the receipt between all the parties involved. To conceptualize this approach, Grigg says that ‘the receipt is the transaction’ and the ledger thus becomes the collection of all receipts (Oliveira Simoyama Et al, 2017).

In 2014, Jason Tyra wrote a short article in Bitcoin Magazine suggesting that using Bitcoin infrastructure, the triple-entry concept proposed by Grigg (2005) is possible and likely to be highly desirable for both companies and external users. Since then, triple-entry accounting associated with blockchain has become the generally accepted definition. The industry has already witnessed the massive potential of triple-entry accounting with blockchain (Weiyi Cai, 2021). The most important innovation introduced by the blockchain technology to accounting applications, it is shown as conversion to the triple-entry bookkeeping system from the traditional double-entry bookkeeping system (Killi, 2019).

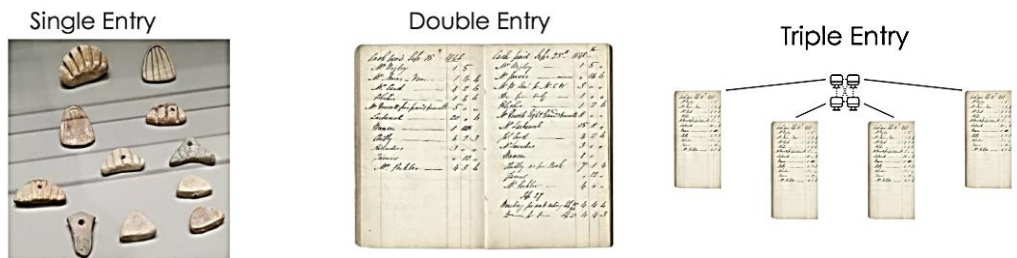


Figure 2: Approach single-entry, double-entry, and Triple-entry

Company A			Company B			Public ledger	
Debit	Credit		Debit	Credit		Company A	Company B
10.000				10.000		-10.000	10.000
	5.000	+	5.000		=	5.000	-5.000
	6.000		6.000			6.000	-6.000
9.000				9.000		-9.000	9.000

### 3. 4. Blockchain

Blockchain is a new technology that was introduced a decade ago, after financial crisis of 2008, and there is still a long way to being accepted and adopted by everyone. The invention of the blockchain that already found an application in finance through the cryptocurrencies, by many is currently considered as the solution to implement the triple entry (Faccia and Roxana Mosteanu, 2019).

Blockchain can be defined as a growing public database of immutable records. Such records are stored in blocks containing data from the previous block, forming a chain, as shown in Figure 3. The block structure built in a linear, chronological order makes fraud very unlikely (Weiyi Cai, 2021). In spite of the fact that the current applications of blockchain generally contain cryptocurrency and commerce exchange data, any sorts of data can be put away in a blockchain. As the title proposes, blockchain stores data within the frame of squares and each piece is associated (chained) to the past pieces (Chowdhury, 2021). To ensure transactions, the cryptography is

used, based on a chain of digital signatures. Each block is a group of transactions that are added to the last block by reaching a consensus on its authenticity among users, which is then passed to each network user to update their database. The Blockchain system records all transactions ever made, shared by consensus distributed and shared among each participant’s users, and it is very difficult to force it. Since every two-key sign-in and any transactions are cryptographed and simultaneously maintained in distributed ledgers of each Node, which make this almost impossible to be hacked (Faccia and Roxana Mosteanu, 2019).

Behind the technology of blockchain, there are complex math calculations, protocols and cryptography to ensure safety of transactions by avoiding fraud, double spending and forging (Oliveira Simoyama Et al, 2017). Blockchains share three common characteristics: a disseminated initiative, peer-to-peer trades, and the utilization of cryptography and hashes (Chowdhury, 2021).

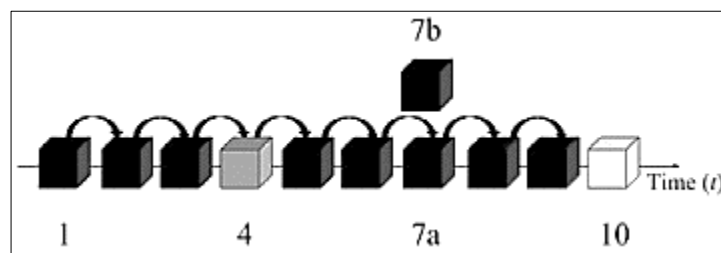


Figure 3: A simple form of a blockchain (Weiyi Cai, 2021)

The basis for triple entries is a unique, cryptographically safe record, called receipt, the full probative proof of proof is provided by the digital signatures of the author, the payer and the accepting issuer, making sure that no party can successfully pass

unauthorized transaction is valid. This reduces the problem of accounting with that of its presence or other type of receipt, which would be guaranteed by dividing the copies between all parties involved (Faccia and Roxana Mosteanu, 2019). In simpler

terms, In effect, Blockchain refers to chained blocks of information, that is, pages of a book accounting system digitally signed in the internet environment that supports digital payment transactions made with cryptocurrencies. In its most primary context, Blockchain refers to open information and accounting system, which allows the control and validation of payment transactions with the particularity of being decentralized, avoiding duplication or digital multiplication of currencies. It has a great potential for diffusion and adaptation, its costs are low and its easy accessibility and high security are revolutionizing the way of recording private transactions. In Blockchain, each record (transactions or economic events) is kept in all the nodes of a network permanently and unalterable, with a chronological order and using

cryptographic techniques to protect the data. These registers are inserted in a block with a protocol that entails their verification and the consensus of all the users of the network. To do this, a series of checks are carried out, such as the absence of duplication and it is chained with the preceding blocks. Therefore, a distributed and replicated database is created in multiple nodes of the network, where each block confirms and links the previous one. Hence, the traceability of the transaction can be tracked with the entire history since its creation, with the assurance that the data could not be altered or modified. To manipulate the data, the consensus of the entire network would be required. Any node can verify that the transaction or event has taken place on the indicated date. (Abad-Segura et al, 2021).

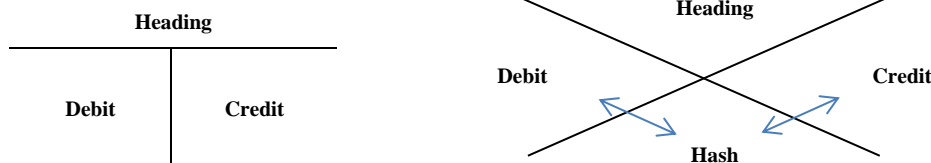


Figure 4: From T-Accounts to X-Accounts (Faccia, Moşteanu and Leonardo, 2020).

### 3. 5. Accounting in Blockchain

Blockchain is a creating advantage technology rather than a revolutionary technology which changes and intervenes traditional accounting recording techniques, creates a new accounting technique. As mentioned, before the invention of blockchain technology, Grigg (2005) proposed a system in which a transaction between the two parties was confirmed by a third party. However, this system required an independent and reliable intermediary to verify each transaction. With the development of blockchain technology, this concept has come up again (Killi, 2019). The move to a financial system with a significant blockchain element offered opportunities and new approaches for accountancy area. Nowadays, blockchain can help accountants to gain clarity over the available resources and obligations of their organizations (Faccia and Roxana Mosteanu, 2019).The most important

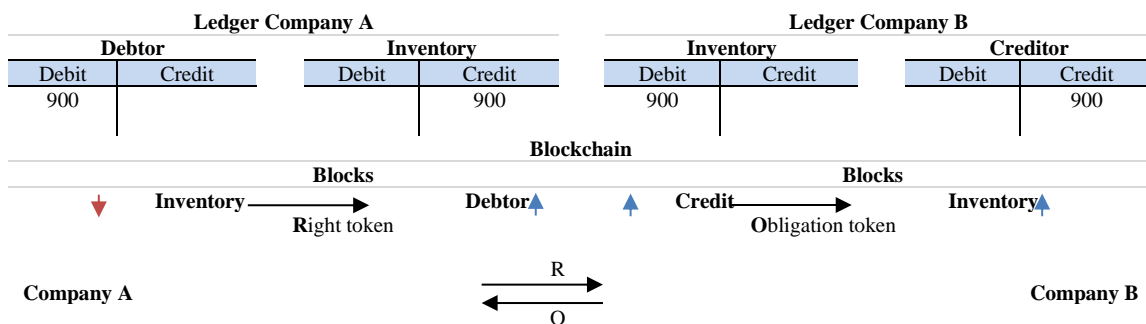
innovation introduced by the blockchain technology to accounting applications, it is shown as conversion to the triple-entry bookkeeping system from the traditional double-entry bookkeeping system (Killi, 2019). Therefore, with the emergence of the blockchain technology another concept is revived – triple-entry bookkeeping (Gröblacher and Mizdraković, 2019).

Blockchain can be used in accounting to record, store, use and share accounting data ensuring transparency and enhancing data quality, through distributed ledger technology without any human intervention. With the replacement of human afford, the blockchain will help accounting to shift from 3rd to 4th industrial revolution (Chowdhury, 2021). It is come to the fore that recording in the blockchain environment of a accounting transaction that occurs with blockchain technology. This technology cause to

be forming of distributed and public accounting records instead of central accounting records. Records made on the blockchain are defined as ‘triple-entry accounting’, because they create a third recording environment in addition to existing double-entry accounting records. Furthermore, this technology is called ‘Real Time Accounting’ because it causes the accounting records to be seen immediately (Killi, 2019).

The use of the words debits and credit, which currently no longer have any intrinsic meaning, is now even misleading. It would probably be more effective to call the two sections of each accounts, left section and right section, so as to avoid any confusion. In fact, for example, the increase of a payable (that is a debt) is recorded in credit (right-hand section) and vice versa the increase of a receivable (that is a credit) is recorded in debit (left-hand section) (Faccia and Roxana Mosteanu, 2019). The basic principle of accounting the blockchain is triple entry accounting. In triple entry accounting we have three different entries: credit, debit and the third entry, the receipt. Instead of using a neutral third party as required in Griggs (2005) suggestion, the blockchain is used. The largest issue with using a neutral third party is the guarantee that the third party will stay neutral, that information is not

lost, nor that the data are potential targets of cyberattacks. When a transaction occurs on the blockchain, a receipt is created. This is stored on the blockchain and all parties involved in the transaction can see it (and if it is a public blockchain everyone can see it) (Gröndahl, Niclas, 2020). Blockchain, for accounting industry, helps the companies to write their transactions directly into a join bookkeeping, creating an interlocking system of enduring accounting records. Double entry accounting has been used for a very long time now. Triple entry accounting adds a level of clarity and honesty to bookkeeping that double-entry accounting cannot offer. Triple entry accounting has address A, address B, and the third address that is the confirmation receipt. The third public ledger allows for both books to reconcile their ledgers and make sure all three records are in a consensus. It is showing all transactions and all debits and credits involved can be seen. It is how, the salient feature of double-entry bookkeeping lies in the integration of flow accounts with stock accounts, its logical extension to triple-entry bookkeeping becomes clear, subsequently an integration of a new set of accounts designed to explain changes in flow accounts (Faccia and Roxana Mosteanu, 2019).



Behind the technology of blockchain, there are complex math calculations, protocols and cryptography to ensure safety of transactions by avoiding fraud, double spending and forging. the main advantages of blockchain technology include the immutability of the records, the distributed database,

the audit trail recording and strong cryptography (Oliveira Simoyama Et al, 2017).The main benefits discussed include reducing the risk of error (especially human error); low risk of fraud (blockchain it is very difficult to penetrate and manipulate); system automation, huge cost savings (by increasing the

efficiency and decreasing in errors), increased reliability in financial reports, and reduced workflow. Nowadays many economists and accountants are saying that at the end of the road, fully automated audits can be real (Faccia and Roxana Mosteanu, 2019).

Blockchain, as well as associated smart contracts, can be leveraged to securely store accounting data, to instantly share relevant information with interested parties, and to increase the verifiability of business data. Using blockchain technology, companies are able to generate new accounting information systems that record validated transactions on secure ledgers. Those transactions will include not only monetary exchanges between two parties, such as payments collected from clients, cash deposited to banks, etc., but also the accounting data flow within a company. Such systems would enable close to real-time reporting by instantly broadcasting accounting information to interested parties, such as managers, auditors, creditors, and stakeholders. Because of the dramatic decrease in the unit cost of processing, memory, and storage, as well as the emergence of distributed public ledgers like blockchain, external participants can access companies' real-time accounting information at low cost. Smart contracts could serve as automatic controls that monitor accounting processes based on predetermined rules. In addition, with the advancement and popularization of the Internet of Things (IoT), controls could be embedded into the blockchain. These IoT-based controls could be incorporated into various physical objects in order to monitor and enact business processes in real time. Moreover, data analytics can also be used in conjunction with blockchain to discover anomalies and other useful information. In this system, managers, accountants, business partners, and investors could actively collaborate to verify transactions, as well as provide reliable evidence for cross-validation. These components should come together and comprise a real-time, verifiable, and transparent accounting ecosystem (Dai and A. Vasarhelyi, 2017). So, the main difference between the traditional databases which currently support accounting and the Blockchain is ability to trust the

execution of transactions between parties, without the need of an intermediary (Bank) to act as a centralized system. In addition, Blockchain allows the possibility of defining degrees of transparency, via the use of cryptography, which allows having a ledger either public or private depending on the user configurations. These features allow the Blockchain to assert itself as a particularly relevant medium for keeping a Journal and a General Ledger shared at an intra-organizational level, as well as with carefully selected external third parties (shareholders or external auditors) and intra-organizational entities may have access to the information related to their roles given the blockchain defined constraints (Gomaa; Boumediene; Gomaa and Farag, 2019).

#### **4. Results**

Accounting has been accompanied by improvements and complexities since ancient times and throughout its thousands of years of life and has changed positively with the impact of its environment. So, accounting is one of the oldest professions in the world, which always seeks to expand its areas of social reporting and accountability to reach its true status, social mission and responsibility, to include the majority of stakeholders. In this regard, in the course of events and discoveries, accounting has been associated with scientific and technological advances, and has increased international awareness and knowledge and the use of methods that can be better useful in decision-making.

Single-entry accounting with the main purpose of registering personal debts covered a limited and specific area, and due to many errors and errors, the ability to manipulate and falsify without trace, the lack of wrong separation from fraud, and the lack of balance in the accounts, had to be changed. In addition, major scandals, lack of transparency and information asymmetry led researchers to think about an intuitive, more accurate and better way to register accounts in offices and financial statements, and the triple-entry accounting system was proposed as an independent paradigm to improve reliability. Although double-entry accounting has been used for a long time,

but triple-entry accounting adds a level of clarity and honesty to accounting that double-entry accounting can't do. However, the beginning form of triple-entry accounting was not very well received. But later this method was developed and a validating and supervisory entity or association was added as a triple or third party entry, which simultaneously encrypts and secures transactions while making conducting transactions.

Triple-entry accounting as a potential approach to reform accounting systems and evidence in an era of technological change can be very important and timely. After the 2008 financial crisis, blockchain technology was recognized. The advent of the blockchain in the process of preparing information and accounting books has made it possible to move from a Triple-entry registration system to a new Triple-entry system. So that this technology maintains the third general ledger of technology transactions and distributes this general ledger among the stakeholders and in this way basically improves the accounting. Blockchain in Accounting helps individuals write their transactions directly in a Triple-entry accounting office with features such as intelligence, integrity, consistency, uniformity, Freedom from bias, timeliness, relevant, comparability, immutability, verifiability, and consistency. And these features can make it more useful in the context of new technologies for the use of all stakeholders. The system's approach to the registration process, encrypted validation such as independent auditing, helps increase transparency, disclosure, public trust and reliability, and this reassurance changes the accounting information system. Although accounting, along with other human sciences, is evolving from traditional approaches to modernism and postmodernism, new technologies such as blockchain still have a long way to go before it can be accepted Accounting public is the knowledge gap between blockchain developers and accounting experts.

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## بلاکچین – تحول در حسابداری

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### چکیده

تکامل حسابداری در راستای مکانیسم تحقق اعتماد متقابل، تئوری نمایندگی، اصل تفکیک شخصیت و عدم تقارن اطلاعاتی بین ذینفعان صورت گرفته است. حسابداری سه طرفه، با ظهور بلاکچین، انقلابی در روش ثبت، کنترل، گزارش و افشای رویدادهای مالی است. ظهور بلاکچین فرصت ها و چالش های جدیدی را برای حسابداری بلاکچین و حسابرسی مداوم ایجاد می کند.

این مطالعه به بررسی درک تغییر روش ها و فرآیندهای حسابداری با توجه به محیط پیرامون و پیشرفت های علم و فناوری می پردازد و آینده ای از حسابداری را نشان می دهد. هدف از این مطالعه، تجزیه و تحلیل تکامل رویه ها و سیستم های حسابداری و بررسی توسعه سیستم حسابداری از یکطرفه به دو طرفه، سپس به سه طرفه و در نهایت حسابداری بلاکچین می باشد. این مقاله با رویکردی توصیفی و بر اساس روش استنادی و کتابخانه ای انجام شده است.

نتایج تحقیق نشان می دهد حسابداری همراه با سایر علوم در حال پیشرفت و گذر از رویکردهای سنتی به مدرنیسم و فرامدرنیسم است و فناوری های جدیدی همچون بلاکچین تحول دیگری را با تغییر فرآیندها و رویکردها عملی در جهت بهبود ویژگی های کیفی و کاهش محدودیت های حسابداری، رقم زده است که با افزایش کارایی، اثربخشی و صرفه اقتصادی حسابداری به ذینفعان کمک می کند

### کلمات کلیدی

بلاکچین، حسابداری، دفترداری یکطرفه، دفترداری دوطرفه، حسابداری سه طرفه

