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The Digital transformation of accounting, through implementing blockchain technology : a conceptual model

La transformation digitale de la comptabilité par la mise en œuvre de la technologie blockchain : modèle conceptuel

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Abstract

This paper aims to present the use of Blockchain and its effects on accounting functions in companies according to many studies published during the last decade in order to establish a conceptual model explaining the sequential effect of the global digitalization wave and how it arrived to management models, then its impact on accounting function based on many factors and characterized by information quality, simplicity of use, cost-cutting and time. In this paper, we'll focus on Blockchain as the main factor of digital accounting. The complexity of blockchain is explained by presenting its infrastructure and analysis of its functionality, which can be summarized in five steps showing the information's path from the beginning of the transaction to the recording. Based on this analysis and according to the literature review, the blockchain effects on accounting are transparency, security, and decentralization, we established a conceptual model that explained the way of digitalization from social influence until the implanting of the blockchain in the accounting system.

Keywords: Digital transformation of management ; digital accounting ; Blockchain infrastructure ; Blockchain functionality

Résumé

Cet article vise à présenter l'utilisation de Blockchain et ses effets sur la comptabilité dans les entreprises selon de nombreuses études publiées au cours de la dernière décennie afin d'établir un modèle conceptuel expliquant l'effet séquentiel de la vague de digitalisation mondiale et comment elle est arrivée aux modèles de du management, puis son impact sur la comptabilité basée sur plusieurs facteurs et caractérisée par la qualité de l'information, la simplicité d'utilisation et la réduction des coûts et du temps. Nous allons nous concentrer sur la mise en œuvre de la blockchain comme le principal facteur de la digitalisation. La complexité de blockchain est expliquée par la présentation de son infrastructure et sa fonctionnalité, qui peut être résumée en cinq étapes montrant le chemin de l'information du le début à l'enregistrement. Selon cette analyse et selon la revue de la littérature, les effets de la blockchain sur la comptabilité sont la transparence, la sécurité et la décentralisation, nous avons établi un modèle conceptuel qui explique le chemin de la digitalisation depuis l'influence sociale jusqu'à l'implantation de la blockchain dans la comptabilité.

Mots clés : Transformation digitale du management ; Comptabilité digitale ; Infrastructures de la blockchain ; fonctionnalité de blockchain

Introduction

The digitalization wave has become a mandatory change for all structures in the last ten years, Enterprises follow the changes that happened in the economies to guarantee a competitive factor against competitors and gain more time and more informations (Bampoky 2017)

Digitalization changes impact the inside organization map, leading to changes in the different functions. Accounting is one of the important functions that allows businesses to receive a lot of information as income from the transactions happening throughout the value chain with suppliers, clients, and banks… all the information passes through an accounting system starting from recording the economic transactions (credits, purchases, sales...) to present the financial reports.

The process of accounting has been developed over several years to enhance the quality of financial reporting, which allows investors and managers to get the ability to make the right decisions at the right time. Accounting has gone through four important historical stages,(Krokhicheva and al. 2020) which are :

- The first stage is when recording economic transactions started 3000 years ago and invented the double recording by Luca Piccoli
- The second stage is between the fifteenth and sixteenth centuries. The creation of a calculating system including indicators to manage turnover sheets and balance sheets was the main characteristic of this stage.
- The third stage, between the seventeenth and eighteenth centuries, a combination of the calculating system and law has been developed to characterize the new accounting function system, to determine the organization's value, to examine the economic and legal process under a new system, which is an audit, and also to create the reporting system as a result of accounting development at this stage
- The fourth stage, in the nineteenth and twentieth centuries, known as the transmission, happened to the accounting system function from a sample calculating and regulatory system to a control system that allows managers to control performance and follow strategic goals to perform efficiently, using many tools based on accounting information (financial and no financial) like cost calculating system. Balanced scorecard….

The development and evolution of the accounting system that happened in the last stages can be explained by the degree of dependency between the internal environment of the organization and the external environment(Chyzhevska and al. 2021). The degree of dependency is becoming more strongly correlated to the changes happening externally in the organizations. In the last 10 years, the digitalization of accounting has become a mandatory necessity for structural change caused by a sequential impact of a global digitalization wave starting with the digitalization of society, then the digitalization of the economy toward the

digitalization of management, and finally accounting (Chyzhevska et al. 2021).

Technology evolution enhances the manager's ability to adopt many technological solutions like Blockchain, artificial intelligence, cloud computing, and big data, which changed accounting tasks forever. The volume of relevant academic research on the operation of the blockchain and its use in accounting has significantly increased since 2016 (Fullana and Ruiz 2021). In order to study the combination, of blockchain and accounting, we propose the main question of this article as follows: **what are the impacts of implanting blockchain technology as a factor of digitalization, on the accounting system?**

But first of all, we need to clarify how the digital transformation arrived at the accounting function so we can present the definition and characteristics of digital accounting. Then we have to analyze the blockchain technology; how it was implanted in finance? what are the characteristics and infrastructures of blockchain? how blockchain technology functions in accounting? We'll present the answers to the previous question in order to establish a conceptual model explaining the digitalization of the accounting function starting from global digitalization until the implanting of blockchain technology throughout the accounting process we'll present the two infrastructures of blockchain internal and external, and its functionality on accounting step by step to understand and to confirm the main characteristics of the new model of digital accounting.

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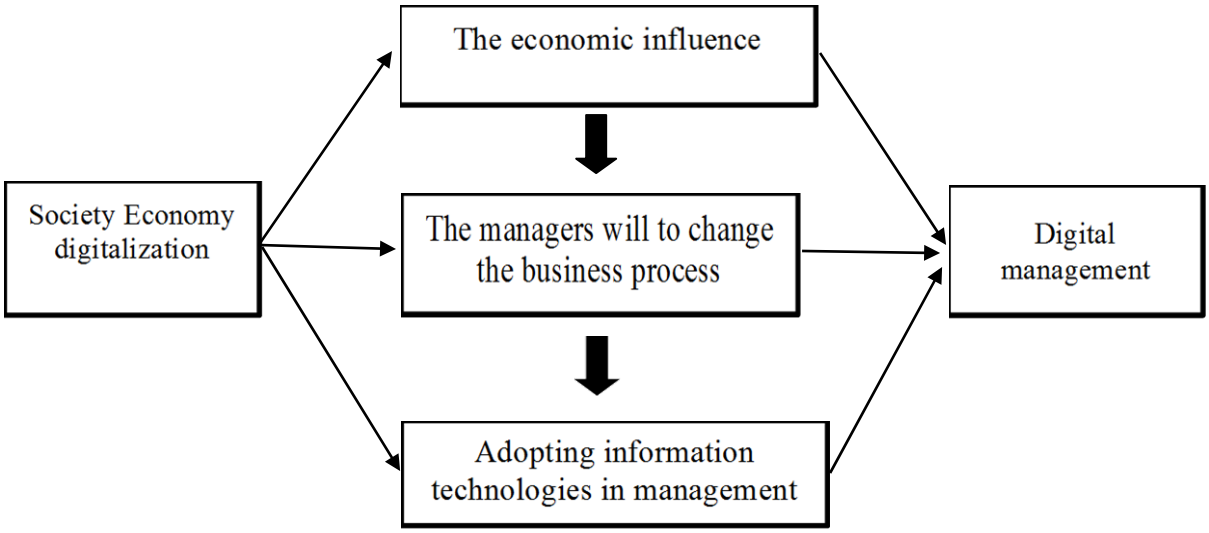
1. Digital transformation of management process

The revolution of the industry 4.0 has impact the global society including economic sectors and management models in companies (Chyzhevska and al. 2021). The speed of innovation and creating new technological tools is happening faster and ever (Jylhä and Syynimaa 2019) and that inspires managers of companies to adopt different technologies inside the organization structural and throughout the value chain, first of all, to survive the economic environment evolution, to gain a competitive edge over competitors and to develop the processes (Phornlaphatrachakorn and Kalasindhu 2021).

Researchers in digitalization field proposed many definitions of digital transformation, according to (Peter, Kraft, and Lindeque 2020), the digitalization transformation is the process of integrating technologies in the organizational workflows, based on paper documents, in order to create or to renew the existing systems. But the adoption of technologies is not enough to transform business models to virtualize ones. The digital transformation of an organization is a several changes that must happen within four levels: first, change in the context which the enterprise function; second, change in the relationship with the main stakeholders (suppliers, employees, costumers…);third, change throughout the process (korchagina 2020 as cited in Platov, Kalemulloev, and Zikirova 2021). The main changes that explain digital transformation can't be applied in business models without the human will, companies managers establish technological changes in order to create value, optimization and opportunities (Phornlaphatrachakorn and Kalasindhu 2021).

The transformation throughout the management process is dependent to many factors, external, like the society and the global economy influence, the speed of innovation and creating new technological tools and internal factors like the manager's will to change the business system and adopt new competitive edge (figure 1).

Figure N°1: Digitalization of management



Source: Authors

2. Digitalization of accounting process

The accounting function is an important function throughout companies' structures, just like the other business functions: marketing, human resources, production… Accounting tasks have been impacted by the digital transformation of management (Chyzhevska et al. 2021). Digital accounting refers to representing financial informations in digital format, the collected data can be deployed or manipulated in an electronic way and also transmitted immediately to the owners (Troshani, Locke, and Rowbottom 2019) the financial data from the cash flows to the balance sheets become easely accessible in few seconds (Berman 2012 as cited in Phornlaphatrachakorn and Kalasindhu 2021) researches present digital accounting according the its benefits (shuraki and al 2021 as cited in Phornlaphatrachakorn and Kalasindhu 2021) confirm that digital accounting is a system of recording characterized by effective combination law cost and short time of processing financial data. (Alfartoosi and Jusoh 2020) proposed a conceptual model to explain the effect of digital accounting on SME's performance, the digital accounting was represented by four characterizes:

- Information quality
- Simple to use
- Cost cutting

- Short time to make decisions

(Phornlaphatrachakorn and Kalasindhu 2021) proved that digital accounting is an automated system which is known by positive strategic consequences on management as the high quality of financial transparency, the usefulness of accounting information and the strategic decisions effectiveness.

The human resources as an important factor in the global digitalization wave, contribute and get affected at the same time by the digitalization of accounting, the technical and innovative part is developed by engineers and data developers in the other side the accountant must develop their knowledge and other technological skills developed more then spreadsheets and ERP, a lot of accountants has lack of ambition and understanding tools like Block chain, artificial intelligence and clouding (Platov, Kalemulloev, and Zikirova 2021) integration of new tools in the accounting system doesn't mean a directly digital transformation, it takes an integrating of employees to learn how to use the new technological process in order to improve the realization of strategic goals also with regard to the performance of personnel digitalization has a positive impact on staff motivation in organizations (Mohamed Achraf and ADIB Mohamed 2020)

The concept of digital accounting is not based only on implanting new innovative technologies which can finish accounting tasks quickly and effectively, the digitalization of the information movement mechanism from a traditional system based on paper documentation to a digital process is based on many factors which can be categorized as, human factors, technological factors, and strategic effects. These factors can be characterized and detailed as follows:

- Implementing of electronic forms
- Automation accounting tasks
- Improving the accountant's skills on the technical side
- Improving the data collecting tools founded on online interactions
- multidimensionality of accounting data role
- Easy to process and use
- Developing channels to transmit information to stakeholders
- Reduction of cost
- Transmission accounting records, accounting journal, and balance sheet in real-time
- High quality of financial information
- Taking strategic decisions in real-time

3. Blockchain technology adopted in accounting system

Blockchain technology was created in 2008 by the Japanese author "Shatoshi Nakamoto" it was associated with the new digital currency Bitcoin (Yli-Huumo et al. 2016) the main role of blockchain at this new payment system is to limit the number of transaction parties. In order to reduce the operation costs, once the transaction is done, the two parties can check the record at any time and from anywhere, this visibility of records enhances transparency and limits the ability to manipulate the records. A blockchain is a synchronized global ledger of occurrences between nodes in a peer-to-peer network, to put it simply. A blockchain, in particular, is copied at each node and aids nodes in establishing consensus on the current state of all accounts (Rückeshäuser 2017).

Desplebin in his article titled "understanding blockchain and what its impact on accounting and its businesses", published in 2019, defines blockchain as a public register that allows the recording of many transactions according to an organized chronological order based on a decentralized network, for example, the internet and the operating system of blockchain is characterized by three principals (Desplebin, Lux, and Petit 2019) :

- *Transparency*

The use of data information is public for all the participants who have access to the network. For any verification or modification, the user must have the permission of other users.

- *Security*

Information is protected against any attempt of fraud because it's impossible to delete information from the nodes and no falsification can happen unless there is a convergence of interests.

- *Decentralization*

The operating system is functioning without any mainframe which can be responsible of administration, control and governance.

4. Blockchain infrastructures and functionality in accounting:

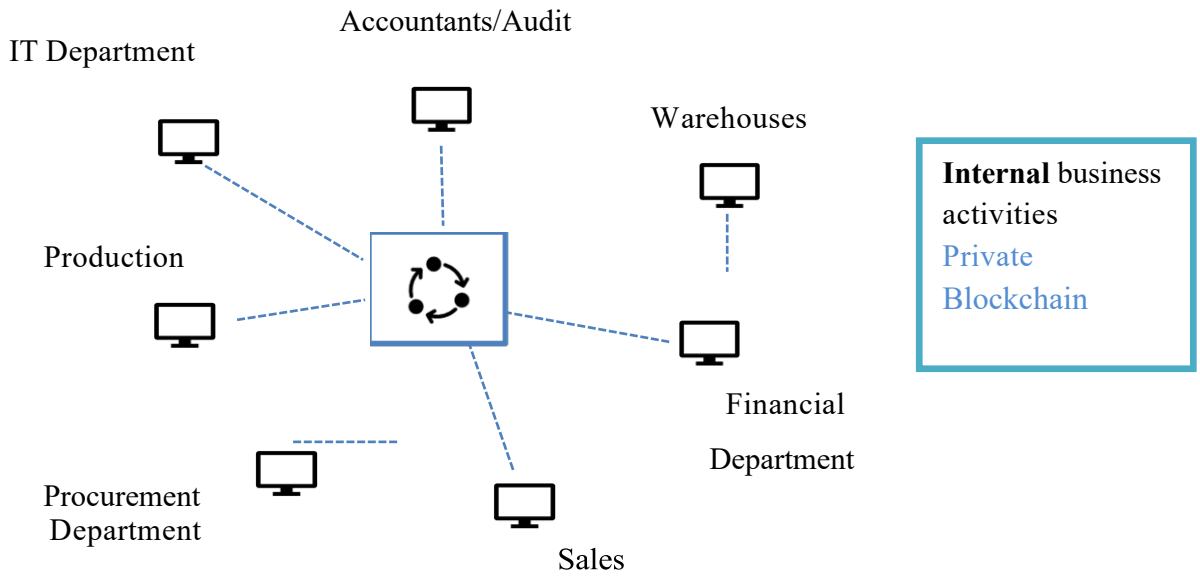
4.1 Blockchain infrastructures

Blockchain applications were extended out of cryptocurrency into many fields: cybersecurity, finance, banking, smart contracts, digital property…Accounting function in companies adopt blockchain technology in order to enhance the efficacity of financial data operating process

(Catalini and Gans, 2016; Mattila, Seppälä, Naucler, Stahl, Tikkanen, Bådenlid & Seppälä, 2016; Benchoufi and Ravaud, 2017; O´Leary, 2017; Umeh, 2018 as cited in Pedreño, Gelashvili, and Nebreda 2021) also there isn't actually a connection between the ledgers of different businesses, either one of them or both could falsify the data, we can't truly speak of a system that is impervious to error. As we presented previously, Blockchain offers more transparency, security, and decentralized control, but to determine the blockchain technology's contribution to the accounting operating process, we need to understand its functionality and how it works.

(Wang, Zhang, and Chang 2020) in their study related to blockchain's application in audit, differentiate between two various types of blockchain infrastructures, internal and external. The internal infrastructure is a private network covering all the organization's internal departments and all the activities done throughout this system (Figure 2). It relates to the different internal functions in privacy permission access. Only members can operate and use shared data in the blocks. The coordination between managers and structural access to information inside the internal environment is based now on the quantity and quality of information shared on different blocks inside the private network (figure 2).

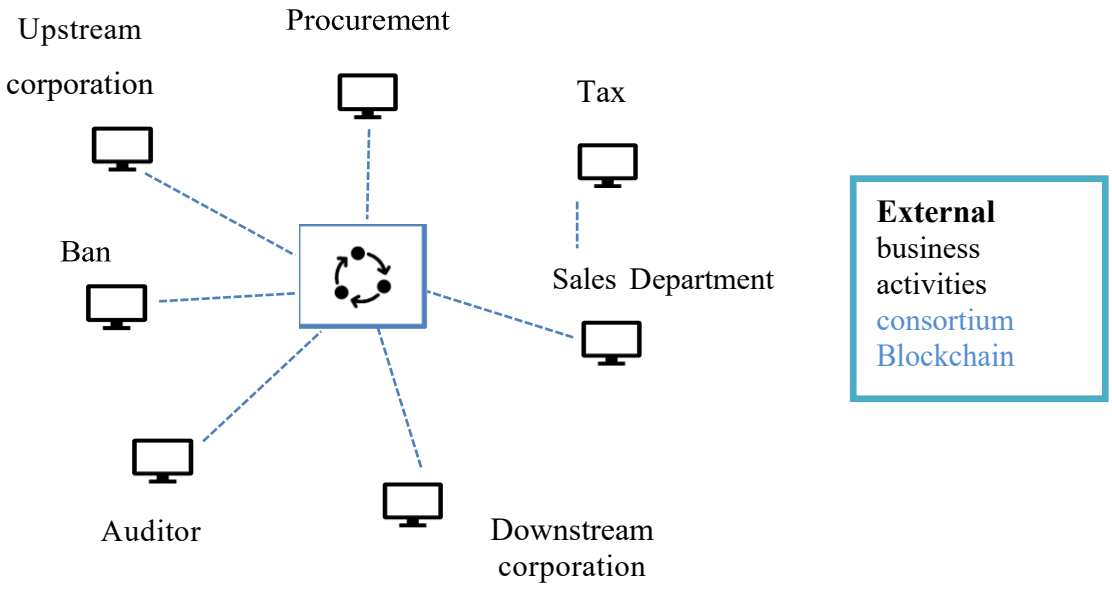
Figure N°2: Blockchain system infrastructure for internal business activities (Ke Wang and al 2020)



Source: A conceptual model for blockchain-based auditing information system (Ke Wang and al 2020)

This time only a few participants named nodes or peer parties from the external environment have the right to access data and record or verify it. It depends on the sort of transaction. The consortium, in this case, is semi-decentralized because the other nodes or participants that are not connected to the transaction can only access it without any right to record or verify, the nodes in this case can be Tax, external auditors, procurement departments, downstream corporation, upstream corporation… as shown in figure 3

Figure N°3: Blockchain system infrastructure for external business activities (Ke Wang and al 2020)



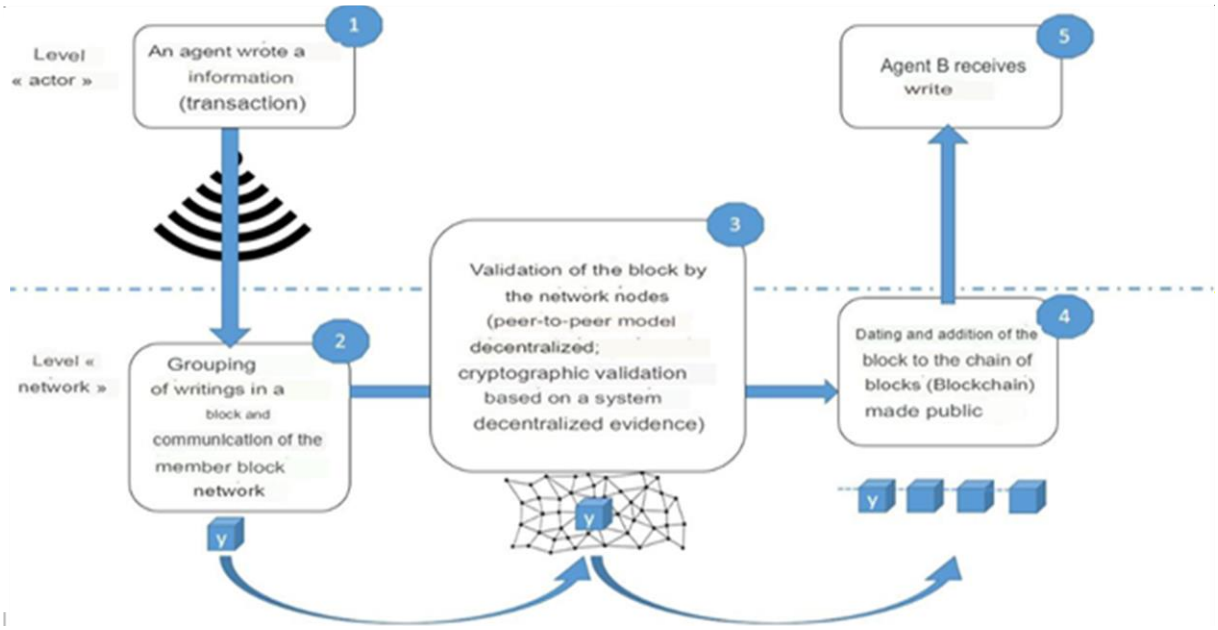
Source: A conceptual model for blockchain-based auditing information system (Ke Wang and al 2020)

4.2 Blockchain functionality in accounting

Since 2016, there has been a considerable rise in the amount of pertinent academic research o n the blockchain's functionality and its application in accounting. (Fullana and Ruiz 2021) authors interested on blockchain and its operating system in accounting published many studies explaining the mechanisms of transactions process throughout blockchain. (Rückeshäuser 2017) (Desplebin et al. 2018) (Desplebin, Lux, and Petit 2019) (Fullana and Ruiz 2021) agreed about five main steps characterizing the functionality of blockchain. In

order to explain these steps, we describe the process followed by the data arising from a transaction involving two actors A and B as shown in the figure 4

Figure N° 4: Blockchain functioning process (Desplebin, Lux, and Petit 2019)



Source: Understanding the blockchain: what are the impacts on accounting and its professions (Desplebin, Lux, and Petit 2019)

Step 1) The transaction starts with a request from agent A to agent B to record the transaction nature (purchase, sale, shipping, transfer of property…) in the private or public ledger (figure 2, figure 3), and the recorded information sent by agent A to the node includes the same type of records organized according to chronological order.

Step 2) The transaction information is now published in the bloc. Members who have the right to access the bloc can see the agent's A transaction request with all other requests. To accept agent's A demand and other information that comes from different transactions, participants must wait in a waiting line in order to validate their requests.

Step 3) The third step is the most important one in blockchain technology, the validation of agent's A request to record the transaction is made by the consortium members based on a

cryptographic protocol peer-to-peer which allowed to organize and identify informational blocs without disclosing their contents which allows the entries' integrity to be confirmed.

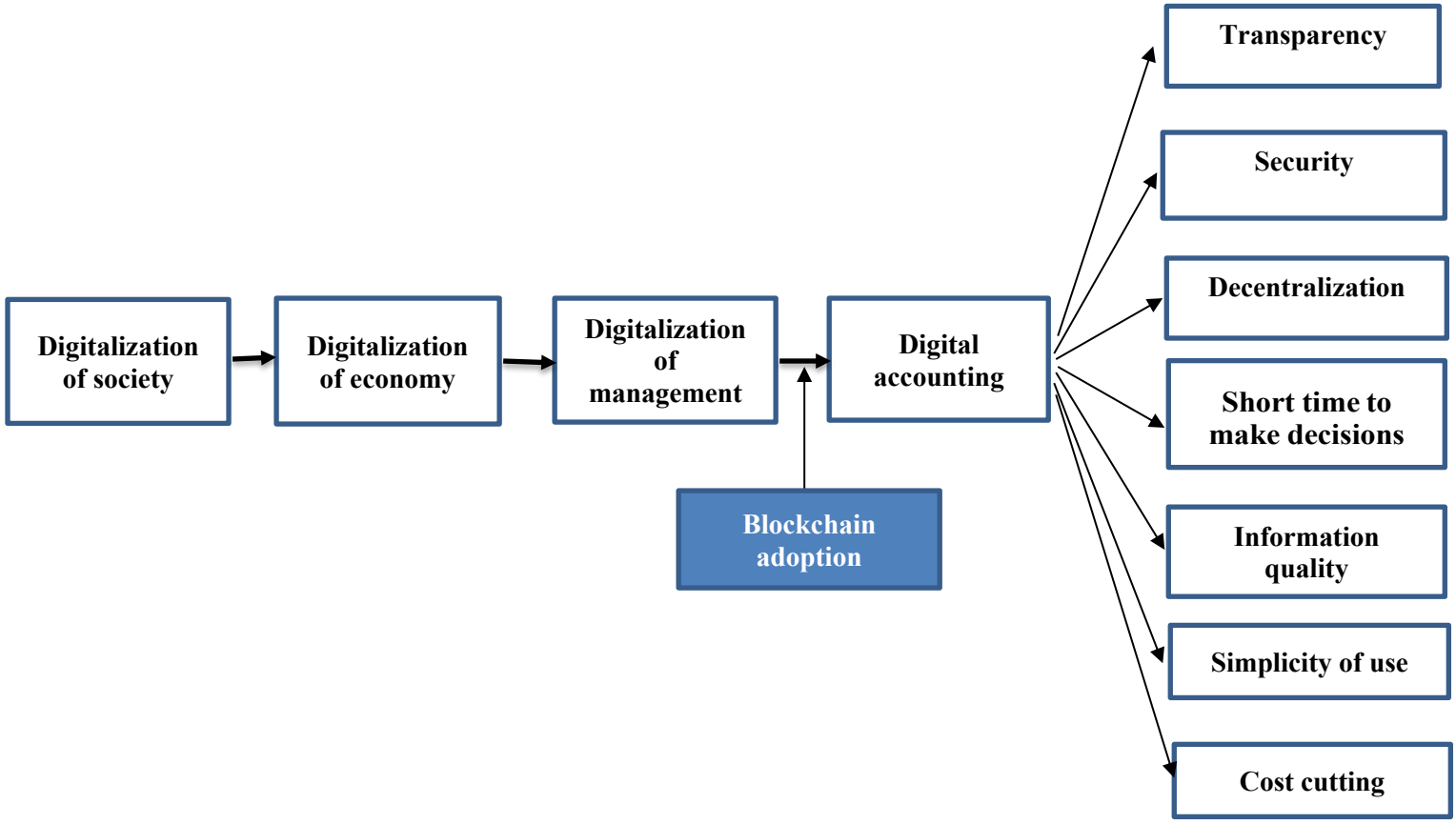
Step 4) after validating the agent A request, the transaction information is added to the blockchain register where all the participants, including agent B, can see the information. The validation at this level is irreversible. Agents A and B have the same copy of the transaction Agreement.

Step 5) Agent B gets records from agent A at this level in order to complete the deal. At this point, the business flow is halfway finished. Agent B's response must follow the same path in order to return to agent A.

The blockchain operating process is based mainly on validation protocol as shown in step number 3. The information validation by nodes enhances the quality of transparency of all transactions that happen internally or externally between the participants. The functionality system allows the development of a dating system in step number 4 which can be a historical database useful for all the internal and external managers and stakeholders to take strategic decisions in the future. Also, it facilitates the verification tasks for the auditors, since all the financial statements and detailed information documents (accounting records, dates..) resulting from different economic transactions are saved in security in the blocks against any attempt of manipulation that can happen by one of the participants.

Based on the previous analysis of blockchain technology's effects on accounting, which are transparency, security, decentralization, short time to make decisions, and the other effects of digitalization on accounting system caused by adopting other technologies. Also, according to the different definitions we presented for digital accounting above, we propose a conceptual model (figure 5) related to the movement of the digitalization wave from general to accounting function with the adoption of blockchain as an important factor.

Figure N°5: Conceptual Model



Source: Authors

Conclusion

The speed of innovation and the development of new technologies, along with internal factors like the manager's desire to change the business system and adopt a new competitive edge, are what drive the transformation throughout the management process, which results in the digitalization of accounting, which is characterized by four characteristics: information quality, simplicity of use, cost savings, and quick time to make decisions. The idea of digital accounting is not just based on implementing new, cutting-edge technologies that can complete accounting tasks quickly and effectively; it is also based on a number of factors that fall under the categories of human factors, technological factors. Since then, the system has been impacted by blockchain as a component of digital accounting. For instance, the three principles of transparency, security, and decentralization define both the internet and the blockchain operating system. The research of two different kinds of blockchain infrastructures, internal and external, reveals these three characteristics. The internal infrastructure is a private network that includes all of the internal departments of the company and all of the operations carried out via this system. It has to do with the various internal privacy permit access operations. The shared data in the blocks can only be operated and used by members. Data access, recording, and verification are rights that participants named nodes or peer parties from the external environment may exercise. Because the other nodes who are not connected to the transaction can only access it without having any right to record or verify, the consortium in this scenario is semidecentralized. In this scenario, the nodes might be tax authorities, auditors, procurement offices,downstream corporations, and upstrem corporations. As seen in step3,the validation protocol forms the foundation of the blockchain operating proces. All the transactions are transparent thanks to the information checking. The functionality system enables step number four's creation of a date system, which can serve as a historical database beneficial for both internal and external managers and stakeholders in making future strategic decisions. The fact that all of the financial statements and specific information documents resulting from various financial transactions are saved in security in the blocks against any attempt of manipulation that could happen by one of the participants also makes the auditors verification tasks easier. Regarding the digitalization transformation factors and also the infrastructure and functionality of blockchain technology, we can conclude that the characteristics of digital accounting are information quality, Simple to use, cost cutting, Short time to make decisions, Transparency, Security, and Decentralization

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