

Blockchain technology in supply chain management and loyalty programs: toward blockchain implementation in retail market

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Abstract—Blockchain was first used in finance, but nowadays this technology is expanding its roots in several areas including retail industry, which is always changing and transforming the way retailers proceed in order to earn customer confidence and build consumer loyalty at a time when it has become easily broken. Nowadays more enterprises are trying to integrate blockchain technology in their systems to improve the performance of their supply chain, although the retail sector has modernized enormously in recent years, despite those progresses blockchain still needs to be developed from retail market perspective. This paper presents an introduction to blockchain technology in a simple way, it also analyses the impact of blockchain technology integration of business processes in the retail industry and tries to study how companies can implement blockchain in the retail industry in order to increase customer loyalty and improve the retail supply chain management. This work adds an interesting contribution of blockchain technology to the existing studies with concerns performance in the supply chain within the retail industry.

Keywords—Blockchain technology, supply chain management, performance, Retail industry, loyalty programs.

I. INTRODUCTION

Supply chain management (SCM) includes several integrated flows such as material, information and financial flow. The management of the supply chain begins with raw material, which is transformed into semi-finished product and then reaches the final product. Modern supply chains contain multi-echelon and geographically disjointed entities which make them inherently complex. Moreover interconnection, multiple policies and different human culture within supply chain network make the evaluation of information very

difficult [1]. Traceability is considered nowadays one of the most important requirements. Indeed, lack of transparency in the supply chain on any step prevents supply chain actors from having a good visibility and taking the right decision. The multiple parameters involved in evaluating intermediates and their transparency complicate taking decisions in managing supply chain, because strategic and competitive decisions always require a certain level of transparency and visibility.[2]

Blockchain technology refers to a distributed ledger technology, enabling each actor of a distributed network to have a copy of an unchangeable ledger of transactions and allows them to be executed without the intervention of intermediates or any third party [3]. This means that blockchain could enables retailers to have more visibility on their stock and helps them to control their sell or buy transactions.

Blockchain technology (BT) has a lot of potential to monitor and track operations in the supply chain and help actors to have more visibility to take decisions by providing business opportunities such as improving the supply chain and reducing non added value operations, time and costs. [4]. The number of studies about BT has increased recently but the studies about their application in different sectors are few [5]. The term Blockchain has been more used recently to represent an innovative technology which could be considered as the next big transformation across industries from finance to medicine to retail.

Research on blockchain implementation is in accordance with the principles of the fourth industrial revolution that is using converging technologies to make computer technology more efficient [6]. Our study when completed could contribute

to make adequate suggestions in the form of rules and strategies that enable the successful implementation of blockchain in retail market. This work would also propose a framework that could become the basis for further studies related to the same issue enabling also a better understanding of the retail market in retail industry.

This paper is structured as follows. Section 2 explains the blockchain technology, whereas Retail industry and its modernization is presented in Section 3. Section 4 explores the application of blockchain technology in retail industry. Finally Section 5 describes the conclusion and limitations of this study and proposes suggestions for further research

II. BLOCKCHAIN

Blockchain is an information transmission system, this transparent and secure technology records all the transactions between users who can also verify the validity of those transmitted data [7].

Basically, blockchains rely on three principles:

- **Transparency:** it enables all the users to see the transactions done from the early time it was done [8].
- **Decentralization:** As this technology is relying on a network so it is not controlled by any entity, but the access is shared among all the users in order to verify the validity of transmitted data [9].
- **Security:** It is mandatory for the user to enter a key each time he wants to record a transaction. So, this data is encrypted and grouped into “blocks”, Then it is submitted for validation by different network nodes. Those steps will make the transactions carried out on blockchains encrypted consequently it is impossible to forge data. The transactions are recorded on all network servers, so, it will be impossible for anyone to modify blockchains or visualize the content of a block without authorization from all the connected computers [10].

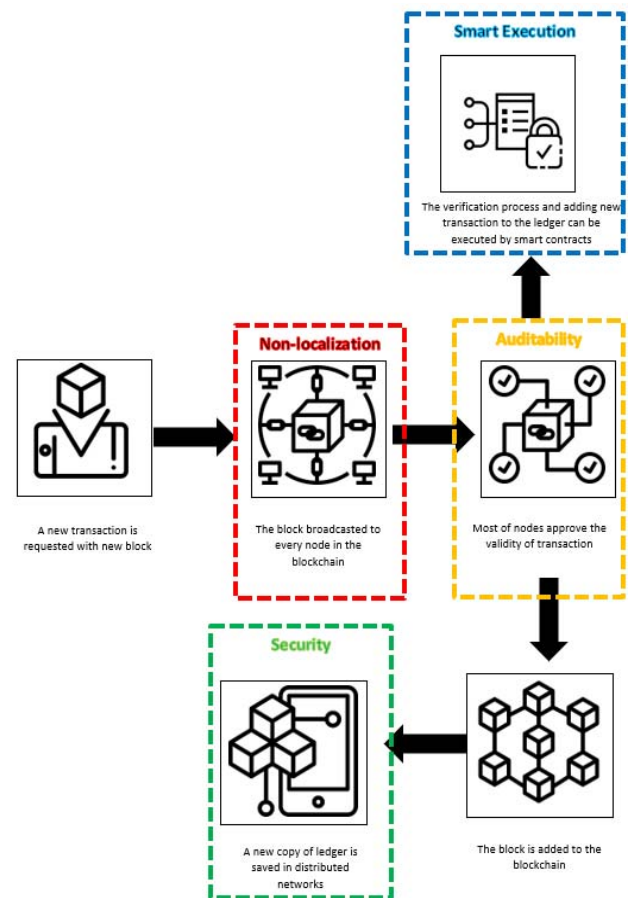


Figure1. Steps in blockchain information and transactions [11]

In blockchain, an agent initiates the creation of a transaction which is going to be added to the blockchain. This transaction is shared in the network for verification. If most of the nodes in the network confirm this transaction according specific rules, this transaction is added to the chain [11]. For security measures, a recording of that transaction is saved in different nodes. In the meantime, the smart contract enables validation of the credibility of transactions without recourse to a third party (see figure 1)

Decentralization is a principal property of blockchain technology enabling auditing of information and validation, each transaction is available to all participants whether it was a public or a private ledger avoiding risk like hacking or crashing [9].

Blockchain technology was first popular in managing the digital currency Bitcoin. Apart from this, blockchain is considered as an innovative flow paradigm with several implications for future developments in different industries like retail. It is the perspective that we take in the remainder of this paper.

III. BACKGROUND OF THE STUDY

Nowadays, in the digital era, the business world is experiencing unprecedented innovative revolution thanks to cutting-edge information and new communication technologies. A highly prominent technology is the blockchain, which has already contributed successfully in the financial industry for several years, now we see that blockchain technology has the potential to transform other industries as well as retail industry. Blockchain is becoming a very crucial issue in retail industry, it is interesting to mention that retail market empowerment through blockchain industry is an important revolution which could totally transform a retail market to digital market. We will see in this work how blockchain represents new links between supplier, customer and by introducing new channels and new proper distribution it also enables a new transaction way to connect all stakeholders of retail market. Blockchain could guarantee a total security for financial transaction in the retail market and can facilitate the introduction of the concept of digital currency in retail market. Therefore, it is necessary to provide models and conditions to structure and ensure a beneficial blockchain implementation in retail market.

Despite the challenges that the retail industry face, researches and empirical literatures on blockchain implementation are few and rarely available [12]. That's why the aim of our study is to propose an initiation to the implementation of blockchain in the retail market that could be a reference to retailers who are ready to integrate this technology in their processes but don't understand its policies with a focus on the role of transaction policy and experience of blockchain. In addition, our study will also analyses the effects of blockchain in retail market.

IV. BLOCKCHAIN IN RETAIL

Proving its usefulness in the Bitcoin application, researchers are eager to explore other areas of application of blockchain technology. One industry presenting interest in this is the retail industry, which sees opportunities in using this technology to improve retail market [13].

The modern retail market is extremely globalized, and supply chains for suppliers to customers is getting more complex. It became usual that a product is produced in China, packaged in UAE and sold in USA [14]. This creates many challenges related for instance to the quality of the products delivered to customers. In case of quality defect detected by customers, we have not only to find the origin of this failure, but we have also to find every person who is impacted by this failure. Standards exist to ensure the traceability in these situations, but the reality is that those standards only require the tracking one step backwards and one step forwards in the supply chain [15].

There is also a growing trend of consumers asking details about the products. They would like to ensure the originality of the products and how well the environmental standards are respected [16]. Moreover, the company is responsible even for behaviors that can be done outside its doors such as its suppliers or customers behavior, that's why companies must

oversee the global supply chain to ensure no misconducts and communicate transparently this to stakeholders. These issues all together are driving companies to improve the way they track and trace products through the supply chain. Sophisticated traceability systems become a necessity to increase the efficiency of the supply chain. The retail industry is transforming constantly by becoming more personalized and offering more personalized shopping experience and faster transactions which accelerates the adoption of new technologies in the retail industry [13].

The retail industry sees potential in using blockchain technology to improve traceability and support retail and e-commerce sector by enabling more visibility and enhancing business models and store fulfillment [13], indeed blockchain applications for retailers are based on permission ledgers, evaluated and confirmed by miners, which ensures traceability and security [8]. From supply chain management to improving customer loyalty programs, below the most useful application of blockchain in retail:

Blockchain-based supply chain : Unlike other applications of blockchain technology like for example Bitcoin which could be public, in our context blockchain networks must be private and permissioned to a limited actors, but at the same time it must keep the door open for more public relationships [17]. New entities will be introduced in the traditional supply chain: **Registrars**: who enables the uniqueness of the identity of users in the network, **Standards Organizations**: which define standard rules for supply chain policies and technological tools. **Certifiers**: they provide certifications to the actors for their participations in the supply chain network. **Actors**: including manufacturers, retailers and providers that must be evaluated by a certified auditor to maintain the system security. Regarding products they may have digital blockchain representation that enables the concerned actors to access directly to the product [18]. This digital blockchain representation could be in the form of an information tag (type of product, standards related to the product ...) attached with the product to give him a virtual identity in the blockchain. Another interesting issue is how the physical flow (materials) will move between stakeholders in the blockchain (see Figure 4) based supply chain, hence the importance of smart contracts, indeed before any transaction between actors, both parties must sign a digital contract or meet a smart contract requirement to authenticate their operation [19]. Once it is done transaction details are updated in the blockchain ledger. Blockchain technology will enables us to answer to the most principal question that any actor of supply chain needs to know which are : (what it is – how it is – how much is there is – where it is – who owns it at any moment) without using any external intermediates. Every detail is recorded in the ledgers with perpetual updates.

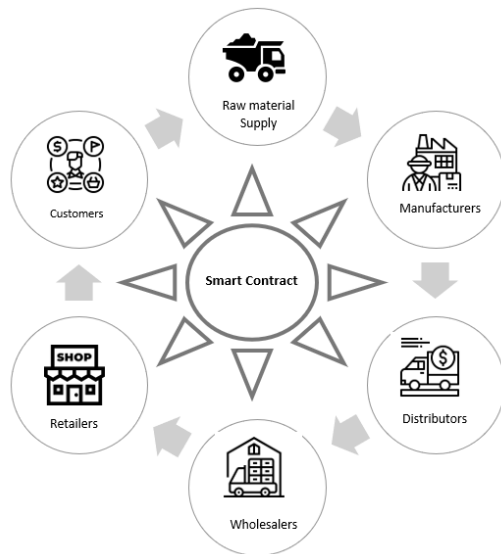


Figure 2: Blockchain based supply chain

Blockchain impacts not only supply chain processes, but has also an important influence on cost reduction and financial transactions between stakeholders. Indeed, one of the most interesting advantages of this technology is the disintermediation of financial intermediaries, whether it was for payments or stock exchanges enabling network saving of millions of dollars [20]. Although smart contracts may organize arrangements between stakeholders to ensure funds for are available when needed. They could also organize the mixity of currencies through transactions in the supply chain in the most secure ways[19].

Moreover, a variety of blockchain technology applications in the company can exist, they are product, service or customer focused. To exemplify another blockchain application related indirectly with supply chain, we turn our discussion to Loyalty programs which considered as one of the most important solutions that retailers use to preserve their customers and community. These facts prompt us to identify future blockchain implications in more ways by considering its several advantages of supply chain particularly and the company generally.

Loyalty programs: loyalty and reward programs are one of the most principal ways retailers are using to preserve their customers, it is identified as one of the most effective ways to secure a brand loyalty [21]. In almost every country (see figure 2), points and rewards are used to earn loyalty and corporate with transparency and honesty [22].

Country	Percentage
Canada	56
US	42
Mexico	39
Brazil	38
Spain	35
UK	45
France	30
Italy	56
Germany	45
Poland	37
South Africa	47
UAE	39
India	33
Thailand	44
Australia	61
Hong Kong	32
Japan	53

Table 1 :Percentage of consumers who make purchases that earn rewards/points at least several times a week – 2019- [22]

With that information which implies that existing programs are not immune to errors of misuse which can cause several issues for retailers if not implemented correctly [23]. Indeed, customer loyalty is too critical to be left to a non-well maintained customer loyalty program, on the customer side many users (see figure 3) feel unsatisfied with loyalty programs ; 96 percent of respondents to the survey confirmed that loyalty programs can be improved and 75 percent of customers confirm that they would switch brands for a better loyalty program[24]. Those confirmations and the fact that 59 percent of customers who have chosen loyalty programs don't use them every time they want to shop is vivid proof that retailers have much work to do when it comes to customer retention [21].

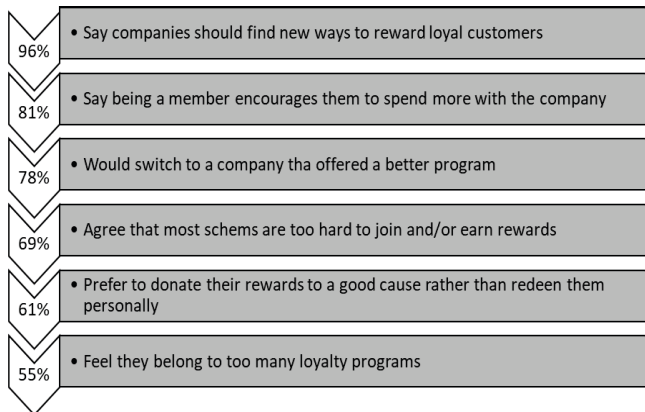


Figure 3 : The truth about customer loyalty, KPMG International, 2019 [22]

Blockchain technology is resolving those issues by offering new methods to handle, secure and centralize loyalty program data. It also streamlines the development of rewards through programs and retailers [22]. Thanks to secured and time-stamped database of transactions, users could secure and track their loyalty programs easily which reduce costs related to complexity of loyalty programs and prevent errors and fraud [23]. Blockchain technology can be an affordable to store and share reward point activity and balances. Unlocking that information will open more ways for customers to stay aware and use their rewards programs, which reinforces brand loyalty [24].

V. CHALLENGES

Blockchain is an emerging technology which is still in the proof of concept phase, there are also some of blockchain types who have not yet proven themselves in an industrial environment consequently real threats and challenges will not appear in the few newt years of its implementation [11]. This implementation must be carefully analyzed and followed before being adopted because any little mistake in implementation would have major risks and bad consequences. Indeed, shared ledgers hold on blockchain contains very sensitive and confidential data which means that cryptography must be robust and insured and protected [10].

Conclusion

In this work, we proposed and discussed the adoption of blockchain technology in the retail industry. The evolution of blockchain and its application in supply chain businesses or loyalty programs is presented which enables the creation of shared, secure, decentralized ledgers, smart contracts, in addition it reduces the use of intermediates which reduce the cost through transactions and operations whether it was related to supply chain or programs of loyalty.

In addition to an overview of blockchain technology and its applicability in different ways in the retail industry, the challenges facing organizations for blockchain technology implementation are discussed in this paper. Companies operating in the retail industry will begin step by step to seize opportunities offered by blockchain technology looking for more transparency, more efficient supply chain management, and reliable loyalty programs for customers and leading retailers to cost saving, customer satisfaction.

Considerable opportunities exist for a better understanding and application to surpass traditional information systems which encourage us as researchers to propose and examine propositions in the domain of retail industry. Understanding the full implications of blockchain technology in the retail industry require multidisciplinary implications and the involvement of organizations to develop standards and rules on blockchain implementation. Undoubtedly, there is a substantial amount of work in this area for future research direction.

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