SCALING BLOCKCHAIN FOR AGRICULTURAL SECTOR: THE AGRIDIGITAL CASE

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Abstract: *New technologies are playing a fundamental role in the postmodern era of globalization where interpersonal interactions at the international level and the exchange of goods, services, information and capital are the basis of all activities. The agriculture sector is constantly facing numerous challenges including the steady growth of the population, climate change, the increasing number of catastrophes, the loss of biodiversity and the spread of parasites. New technology applications such as Blockchain, Internet of things (IoT), drones, Big Data and artificial intelligence can provide the various players in the agriculture value chain with new tools and key technologies to improve production and distribution processes. To demonstrate the importance of applying the Blockchain in the agriculture sector, the case of the AgriDigital platform will be examined. AgriDigital is a cloud-based raw materials management platform that has started the implementation of the Blockchain in agricultural supply chains.*

Keywords: *Blockchain, Agricultural Sector, Innovation Management.*

1. INTRODUCTION

New technologies are playing a fundamental role in the postmodern era of globalization where interpersonal interactions at the international level and the exchange of goods, services, information and capital are the basis of all activities. Blockchain technology, in particular, is attracting more and more interest from the academic world but also from the corporate sector.

By allowing immutable and decentralized transactions, Blockchain technology is applied in various sectors, financial and non-financial sectors.

More specifically, the agriculture sector is constantly facing numerous challenges including the steady growth of the population, climate change, the increasing number of catastrophes, the loss of biodiversity and the spread of parasites. Therefore, innovation in agricultural processes is necessary to overcome them and make agriculture a profitable activity for small and large farmers.

New technology applications such as Blockchain, Internet of things (IoT), drones, Big Data and artificial intelligence can provide the various players in the agriculture value chain with new tools and key technologies to improve production and distribution processes. Despite its great potential, it is essential to also consider the relative costs and implementation risks in assessing the possibility of using it within the sectors of the economy.

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To verify whether a process could benefit from a Blockchain-based solution, the first step is to identify use cases, followed by the identification of the fundamental guidelines of the process (including regulatory requirements, stakeholders, legal framework, interoperability with the existing system and other key requirements) and then the determination of the technology that could help address the challenges in the particular case analyzed. In many cases, in fact, a much simpler digital solution could be the answer to the problem.

To demonstrate the importance of applying the Blockchain in the agriculture sector, the case of the AgriDigital platform, an Australian company based in Sydney, will be examined. AgriDigital is a cloud-based raw materials management platform that has started the implementation of the Blockchain in agricultural supply chains, which represents a significant example of the benefits that these solutions can bring to agricultural businesses and entrepreneurs. The platform allows the management of goods, the traceability of food and the perfect information of customers regarding the origin of the products using precisely a Blockchain protocol. In addition, AgriDigital is continuing to invest and develop new solutions to expand its horizons to new sectors.

2. BLOCKCHAIN LITERATURE REVIEW

The birth of the Blockchain is linked to the publication of the white paper entitled „Bitcoin: A Peer-to-Peer Electronic Cash System" in 2008 by Satoshi Nakamoto, whose identity is still unknown.

This paper describes a purely peer-to-peer version of electronic money known as Bitcoin.

With this event, Blockchain technology, literally a chain of blocks, made its public debut. The Blockchain is a type of Distributed Ledger Technology (DLT), a distributed, shared, encrypted database that acts as an irreversible and incorruptible repository of information. It is a digital platform that stores and verifies the entire chronology of transactions between users through the network (Nakamoto, 2008)

There is no unanimously accepted definition of blockchain. Nevertheless, it is possible to outline three complementary conceptualizations of this technology (Mavilia and Pisani, 2018)

From a technical point of view, the Blockchain is a database consisting of a ledger divided between users and can be openly inspected; it is not, therefore, physically present in a single server, but is placed on several computers at the same time, all synchronized real-time.

From the business point of view, it is a network where transactions, exchanges of values and exchanges of goods between users can be carried out without the existence of central mediators.

On the other hand, from a legal point of view, the Blockchain validates transactions, replacing the old centralized bodies.

To date, the most promising applications of this technology can be seen in the financial sector. Additional fields of application can be identified in the insurance sector (Dai and Vasarhelyi, 2017), data protection, intellectual property protection, electronic voting system, identity verification but also government services, the health sector and medical research (Nichol, 2016), in general for social purpose and catching-up of developing countries (Mavilia and Pisani, 2019).

3. BLOCKCHAIN APPLICATIONS IN AGRICULTURAL SECTOR

To generalize, the applications of this technology can be divided into two macro-groups: financial and non-financial applications.

As for the second area of application, numerous studies and numerous pilot projects have been launched to evaluate the blockchain applications in the agricultural sector, as following (Tripoli and Schmidhuber, 2018):

The agricultural supply chains present substantial inefficiencies, which affect all the players in the chain, from producers to consumers. It is estimated that the cost of operational supply chains constitutes two-thirds of the final cost of goods (Niforos, 2017).

The blockchain stores immutable records that are transparent and, in theory, accessible to any user. This technology has the potential to create huge efficiencies for each actor in the supply chain. The blockchain provides a platform for traceability in agricultural supply chains. It is thus able to keep track of the origin and guarantee the authenticity of agricultural products. In fact, food is the most direct way to get in touch with a place (Baralla et al., 2018).

This solution will make regulatory control easier as the product can be traced along the entire supply chain and possible fraudulent behavior that is discouraged in this way can be identified. However, elements such as hierarchy, Blockchain experiences and the industrial sector have a significant impact on logistics professionals in this field. (Hackius and Petersen, 2017).

The greater traceability of the production and processing of agricultural products will improve the ability to ensure compliance with food standards (national and international) and sustainability.

In addition, the agricultural sector will benefit from the blockchain to reduce costs, risks for sellers and banks and bring greater efficiency gains to supply chains for commercial financing operations. The blockchain uses smart contracts to automatically execute payment settlement in real time, evaluating delivery first, then verifying that the buyer has sufficient funds and finally securing the funds on behalf of the buyer awaiting delivery. These smart contracts can facilitate entrepreneurial collaboration of inter-organizational business processes in the context of smart rural supply chains (Prause and Boevsky, 2019).

The blockchain can also increase access to commercial finance. Commercial finance has not been able to meet demand, particularly from SMEs and emerging economies. Other types of financial services, such as payment, insurance and credit services, can also be carried out using this technology, thus helping the actors in the agricultural supply chain to reduce risk, manage liquidity and maximize returns.

As for payments, for many players in the agricultural value chain, financial transactions are mainly based on cash. This process is slow and expensive and is subject to risks such as theft and loss. Digital payment services make it possible to reduce costs and risks deriving from cash-based transactions, also generating data on the cash flows of the actors in the value chain that can be used to assess credit risk.

As for insurance applications, agricultural insurance is a risk management tool that helps stabilize agricultural income and investments in the event of losses. Insurance payments would become fully digitized and automated with the use of smart contracts and better insurance coverage would be possible.

As regards the credit sector, the main impediments for financial institutions to supply credit products to the sector are the cost of maintaining remote areas, the lack of data to assess the creditworthiness of the applicants or the guarantees.

The blockchain could provide financial institutions with data on the operations of farmers and other players in the value chain necessary to provide numerous financial services.

Agricultural markets are inherently volatile and agricultural and price incomes are vulnerable to exogenous shocks. Derivatives are used as a risk management tool to cover price risk and set a future price for the harvest. The blockchain could also be applied in agricultural derivatives markets.

Through blockchain technology, users are able to build digital identities. Blockchain technology generates a large amount of data from transactions in agricultural supply chains and agricultural financial services. The blockchain technology stores each recorded transaction, able to provide the actors in the supply chain with detailed records of their operations, financial service activities and more accurate and better-quality market information.

Blockchain technology could potentially act as a core technology that integrates other emerging digital technologies into its platform to continuously improve the management of the agricultural supply chain such as artificial intelligence, IoT, big data and 3D printing.

In addition, the blockchain is able to address many of the shortcomings of traditional land registry. This is because it provides a secure, fast and immutable method for registering land titles, which will promote trust in the reliability of the system. A virtuous example is land management in Ghana (Ender, 2019).

4. CASE STUDY: AGRIDIGITAL

AgriDigital was founded to solve some challenges of agri-food supply chains (FAO, 2019). The main crucial issues are related to some problems such as: The payment of the farmers is not contextual to the delivery of the goods; buyers do not have access to flexible financing to pay farmers; consumers do not know where the food comes from.

The AgriDigital platform simplifies and automates business processes for farmers and buyers, acquiring data on the goods and facilitating the transfer and reconciliation of data. The platform offered a huge leap forward in the management of raw materials.

Three pilot projects were conducted using the blockchain in order to generate a digital title on a physical product and perform payment on the blockchain, use the blockchain to track the movement of goods.

The objective was to verify whether the AgriDigital platform, supported by the blockchain, could facilitate the purchase and sale transactions.

These pilot projects have demonstrated the ability to eliminate counterparty risk by performing commodity transactions on a blockchain, allowing the supply chain to operate effectively and efficiently.

5. LIMITS, CHALLENGES AND RECOMMENDATIONS

The AgriDigital raw materials management platform is one of the existing blockchain solutions able to show how this technology can be a profitable solution for companies. This case study allows us to show how the applications of the blockchain can be feasible even in a non-financial context in terms of application potential.

These solutions aim to eliminate counterparty risk and reduce existing inefficiencies in the agricultural sector in order to bring more autonomy and control to farmers and their businesses.

However, there are some critical issues and additional challenges that need to be taken into consideration linked to the intrinsic characteristics of the blockchain technology and beyond.

First of all, it is necessary to create a robust digital infrastructure of IoT devices, sensors and integrations to ensure that the digital resource is reliable.

To do this, it is also necessary to have certainty about the inputs to be certified at each step to ensure that the information contained on the Blockchain is not only immutable but also accurate and truthful.

A further element to be taken into consideration is related to the level of digital connectivity that can be a problem in certain areas of the world where the connection is limited or even absent.

In order for these blockchain applications to be realized it is crucial that incentives are provided and that cooperation between the different actors in the value chain is encouraged.

Sometimes it happens that the various stakeholders have different and even conflicting interests.

All these aspects can be a reason for delaying the positive applicability and implementation of these blockchain solutions.

6. CONCLUSION

Through the analyzes carried out, this paper investigated how new technologies and, in particular, Blockchain technology can be implemented in various projects and initiatives in the agricultural sector, aiming to create trust within value chains and make them transparent and sustainable, integrating all the main stakeholders. Despite this, it is also true that there are still many aspects to be improved and problems to be solved, both technically and beyond.

The case of the AgriDigital platform, specifically, shows how it is possible, through the new technological tools, to mitigate the counterparty risk in agricultural transactions up to eliminating it, making secure payments and allowing the traceability and transparency that agricultural value chains need.

Further future research will aim to investigate if and how the challenges that still characterize these applications can be definitively overcome so as to confirm the Blockchain as a safe, reliable and transparent way to guarantee the traceability and integrity of agricultural products, in addition to further applications in the same sector.

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