



Application of blockchain technology in the development of agricultural supply chains in Can Tho City

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ABSTRACT

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In recent years, blockchain technology has garnered significant attention from businesses and researchers due to its prominence. Blockchain is being widely used in logistics activities such as traceability of goods, digitization, reducing intermediaries in the supply chain, enhancing data security for integrated information sharing, and smart contracts. This research was conducted to examine the application of blockchain technology in the development of agrifood supply chains in Can Tho City. The study employs a qualitative research method to gather data from various sources, including domestic and international books, journals, and reports from relevant governmental agencies. Based on the analysis results, the study proposes several solutions to promote the application of blockchain technology in the development of agricultural supply chains in Can Tho, such as enhancing the capacity of stakeholders in the supply chain, further disseminating the benefits of blockchain technology, building infrastructure, strengthening cooperation among stakeholders, or implementing additional financial support policies.

1. INTRODUCTION

In recent years, Blockchain technology has been one of the most widely researched topics when discussing the development of the 4.0 technology revolution. Blockchain is defined as a chain of linked blocks, in which all data is encrypted into blocks and securely linked

together into a chain. Blockchain technology can be imagined as an automated digital accounting ledger capable of verifying transactions between two entities efficiently, securely, and transparently on a globally interacting system. Previously, blockchain was most widely applied in cryptocurrency transaction systems (bitcoin)

(Tijan et al., 2019). However, currently, blockchain technology is also being used in many different fields such as construction, healthcare, manufacturing, and especially in the development of agricultural supply chains.

Can Tho City, with its position as the center of the Mekong Delta region, is an important transportation hub for waterways, roads, sea, and air, a major economic exchange point, as well as a key economic region. Accordingly, the city's agricultural sector is focusing on development towards urban agriculture, high-tech agriculture, applying biotechnology, advanced quality management processes, and modern post-harvest processing and preservation technologies, aiming to create high value-added agricultural and aquatic products that meet the quality and standard requirements of domestic and international consumption markets (Tuan, 2022). Currently, rice production, fruit trees, and aquaculture are the three main agricultural product value chains of the city with an output of 1.3 million tons of rice; 200,000 tons of fruit trees and 220,000 tons of seafood each year. However, production according to VietGAP, Global GAP standards and standards of importing countries, production associated with traceability, and brand building to bring goods according to globally recognized standards to consumers are always challenges that the city's agricultural sector has to face (Hai, 2024). Therefore, the purpose of this research is to analyze the role of Blockchain technology in the agricultural supply chain, especially its impact on transparency, traceability, and operational efficiency of the chain. In addition, the study also focuses on evaluating the current situation of the agricultural supply chain in Can Tho, thereby identifying

challenges, opportunities, and proposing solutions for applying Blockchain in the agricultural supply chain.

1.1 Agricultural supply chain

The concept of Agri-food supply chain (ASC) was first proposed by scholars in the field of agricultural management and economics. In addition, several other terms are often used to describe this concept, including agricultural supply chain, agricultural value chain, food supply chain, and food value chain. In general, an agricultural supply chain refers to the management of relationships between the supply of raw materials for agricultural production, production processing, logistics, and product distribution to consumers. The agricultural supply chain is considered a linked chain from farm to fork, including cultivation, production, processing, business, distribution, and consumption. Since the agricultural supply chain is responsible for providing agricultural products to consumers, maintaining the smooth operation of the entire chain is important in an increasingly volatile social environment. However, agri-food chains always have typical characteristics such as perishability, long production cycles, seasonality, food safety, and product origin (Luo et al., 2018).

1.2 Blockchain technology

Blockchain is defined as a type of technology that uses different blocks, and these blocks are linked together to form chains. A block here is a block of digital information containing a lot of digitized and encrypted data. Each block will contain basic transaction information such as transaction time, amount of money, performer, transaction content, and the hash of that block. These information blocks will be linked together to form a chain of digital information blocks and

stored in a ledger called Ledger. This ledger is not stored in a central server but is linked globally through a network of peer-to-peer computers that store data and perform calculations. Each of these computers represents a "node" of the blockchain network, and each node has a copy of this ledger file (Golosova & Romanovs, 2018). Based on these characteristics, the information in each block cannot be controlled by one party, but is controlled by all participating parties. Therefore, it is very difficult to change the information already recorded in the blockchain, because to change the information, the consent of all parties participating in the chain is required. With this decentralized operating method, it is very difficult to manipulate, forge, or alter data in the blockchain because all information is transparent to all participating parties, and it is very easy to trace data in the blocks (Tijan et al., 2019).

Regarding the operating process, because blockchain operates based on the formation of individual information blocks, when an information block receives new data, that block will be automatically linked to the blockchain. And for each new block to be linked to the blockchain, the following conditions must be met: the transaction must be actually performed, the transaction must be verified, the transaction must be stored, and that information block will be encrypted with a unique code. Therefore, based on these characteristics, blockchain or blockchain technology will be a secure and transparent information storage system when applied in managing a supply chain from manufacturers, retailers, logistics providers, and regulatory agencies (Golosova & Romanovs, 2018).

1.3 Benefits of blockchain technology in the development of agricultural supply chains

Blockchain technology is very suitable for managing and developing supply chains, especially in agricultural supply chains. Blockchain technology supports monitoring information flows, financial flows, and material flows from farm to fork. According to Patelli & Mandrioli (2020), using blockchain technology will support the food traceability process, which is one of the important factors in ensuring food quality and safety, creating consumer trust and satisfaction. This is because when blockchain is applied, all processes in the supply chain can be clearly displayed and supported for tracking at any step from cultivation, production, processing, to distribution.

In addition, integrating blockchain technology into the agricultural supply chain model will bring many benefits, including establishing relationships among entities participating in the supply chain, along with building a transparent network for relevant parties in the supply chain to check and receive related information. From there, production and distribution units can easily manage products remotely and track information from the source to the user effectively without going through intermediaries (Patelli & Mandrioli, 2020).

Furthermore, blockchain can be used to build smart contracts, so that transactions among participants in the supply chain will be transparent and secure due to constant monitoring. From there, it will help save time and costs for businesses, improve product quality, and bring higher profits to businesses (Golosova & Romanovs, 2018).

2. RESEARCH METHODS

In this research paper, the authors will use qualitative methods to collect secondary data

from domestic and international articles, journals, and theses. In addition, the research also uses data sources cited from reports of relevant agencies and departments to further support the topic. The research primarily uses keywords such as "agricultural supply chain", "agrifood supply chain", "blockchain", and "blockchain technology" to search for references. After collecting data, the authors proceeded to synthesize and analyze relevant data and information to examine the current situation and propose solutions.

3. RESULTS AND DISCUSSION

3.1 Current situation of agricultural supply chain development in Can Tho City

To expand markets and build a clean agricultural supply chain to create a link between producers and consumers, the city is focusing on forming a safe agricultural supply chain to enhance product value and meet the demand for safe food for the people. Can Tho currently has 107 traditional markets, 19 large supermarkets, and hundreds of convenience stores. These are major consumers of agricultural products, thus requiring compliance with food safety and hygiene and traceability requirements for agricultural products. Understanding these needs, the city is currently developing high-tech safe vegetable production areas covering over 229 hectares in various districts. In addition, to produce clean products, the agricultural sector also guides farmers to apply advanced production processes and high technology to improve product quality, value, and ensure food safety according to VietGAP standards (Le, 2019).

Furthermore, since 2018, the city has supported over 107,000 electronic traceability stamps, providing full product information,

including promotion and ensuring traceability from initial production to retail. By 2019, Can Tho had guided the updating of information and created traceability codes for 37 agricultural product processing facilities with 82 products (of which 31 products in the safe food supply chain will be granted traceability codes). Simultaneously, the local agricultural sector also built clean production chains for farmers, cooperatives, and businesses, gradually innovating production methods according to a linked model throughout the production process to create products that ensure food safety and traceability. Currently, Can Tho City has built and certified 239 safe food supply chain products. Specifically, there are 12 aquatic product chains with 53 products, 18 plant-based product chains with 163 products, and finally 10 animal product chains with 23 products (Le, 2019).

Despite the achievements, there are still some limitations, including difficulties in applying technology for traceability among farmers, who are not accustomed to using technology in supply chain management, leading to challenges in implementing technological applications. Additionally, some stakeholders in the supply chain, including farmers, producers, distributors, and retailers, are still not fully aware of the features and importance of applying technology in developing agricultural supply chains, leading to a lack of stable synchronization across stages. Furthermore, the state currently lacks strict legal frameworks for applying blockchain technology in manufacturing businesses. At the same time, investment in agricultural and rural development, although prioritized, is not commensurate with the city's agricultural development requirements and tasks. In addition, mechanisms and policies

to attract investment from businesses into agriculture and rural areas are still limited, and implementation has not achieved the desired effectiveness (Vo et al., 2023).

3.2 Impact of blockchain technology on the agricultural supply chain in Can Tho City

The explosion of the Internet and smart electronic devices allows consumers to access all information about a product before making a purchase decision. With the increasing trend of using safe products, consumers are now not only concerned about food quality, but they also want to know the origin of the food, as well as how the product production process takes place (Tran, 2023). Currently, provinces and cities in the Mekong Delta in general, and Can Tho City in particular, have only stopped at producing clean agricultural products and do not yet have technology to prove to consumers that they are clean agricultural products. Therefore, consumers can hardly fully trace the origin information of the products they are consuming. That is why many places are starting to introduce blockchain into the agricultural value chain to manage quality, traceability, and planting area codes, thereby enhancing product reputation and value (Lac, 2024).

3.3 Discussion

To overcome difficulties and challenges in developing the agricultural supply chain in Can Tho City and to apply blockchain technology more effectively, the authors propose the following solutions: First, it is necessary to train farmers in the locality on how to use applications installed on electronic devices such as smartphones or tablets so that they become familiar and proficient in using technology. This will help them manage the cultivation process

and distribution of agricultural products through the application more efficiently. Second, it is necessary to promote and disseminate the benefits and effective features of blockchain technology to all relevant parties in the supply chain. Users need to understand how feasible this technology is and what it can bring to them. When they understand the benefits that blockchain brings, the parties will cooperate with each other, thereby maximizing the effectiveness of blockchain. Third, it is necessary to consider building a strict, flexible, and appropriate legal framework so that businesses can easily implement the application of technology in the production and distribution of agricultural products. Fourth, it is necessary to build more information technology infrastructure. The agricultural supply chain involves many processing and combining stages, so delays in network systems and connections will result in more time and costs for participating entities. Therefore, infrastructure needs to be upgraded to most effectively apply blockchain technology. Fifth, it is necessary to consider building more effective cooperative relationships among partners in the supply chain. Conditions can be created for farmers, cooperatives, and businesses to discuss and find the best coordination method for the entire supply chain. This will help increase flexibility and improve the production, transportation, and distribution processes of products. Sixth, there needs to be additional financial support policies for stakeholders in the agricultural supply chain, especially farmers and cooperatives, in the process of applying blockchain technology to develop the agricultural supply chain.

4. CONCLUSION

Blockchain technology is currently becoming a prominent trend and is evaluated to bring great benefits to socio-economic development in the future. The application of blockchain in the development of agri-food supply chains is an inevitable trend for Vietnam in general and Can Tho City in particular. Blockchain is very suitable for managing and developing agricultural supply chains because it can support monitoring and create a transparent network to minimize the possibility of fraud in the supply chain. In addition, blockchain technology helps trace product origin, ensuring food quality and safety, thereby building consumer trust and satisfaction. When integrated into agricultural production, blockchain technology will contribute to increasing product value and competitiveness for businesses in Can Tho City.

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