Chapter 4
The Use of Blockchain in Vietnam's Global Fishery Supply Chain Management

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Abstract The issue of traceability has emerged as a fundamental tenet of sound logistics and supply chain management. In order to assess this issue, our study investigates the use of blockchain-based traceability frameworks to manage fisheries supply chains in Vietnam. From a methodological perspective, we assessed the contemporary empirical literature to research to achieve four key objectives. First, to provide a comprehensive analysis of the advantages and potential applications of blockchain from a Vietnamese fisheries perspective. Second, to present an application framework that consists of four stages, with the aim of improving the transparency and security of transaction information by adopting Internet of Things (IoT) and blockchain in each of the connections throughout the fishery supply chain. Third, to illustrate the five transformational phases in which blockchain technology can be applied to small and medium enterprises (SMEs) operating in the fishery industry. Finally, to establish a set of policy implications based around the infrastructural, regulatory gaps and human capital that exist in the fishery industry in Vietnam and affect blockchain. From our analysis, we find substantial cause for optimism about the role of blockchain can play as an engine of growth in Vietnam's fishery export industry.

Keywords Blockchain · Traceability · Transparancy · Vietnam fishery · Logistics · Supply chain

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4.1 Introduction

The logistics and supply chain management process play an important role in the international trade area as the logistics and supply chain is part of every aspect of the trading and production process (Wu et al., 2021a, b, c). Companies use these concepts to plan, control, and implement procedures that manage not only the flow of goods and services, but also the effective and efficient storage and transportation of products, as well as the tracking of the products from the point of origin to the point of consumption. In Vietnam, these two activities have formed essential components of all major logistics and supply chain related industries, including the fishery sector, which plays a key role in Vietnam's export and trade development. This study focuses on issues of logistics and supply chain management that relate to Vietnam's fishery sector.

One persistent problem of the fishery logistics and supply chain in Vietnam is lack of transparency, which leads to a decrease in product quality. As a result, the product's added value remains low with a lot of products returned from the importers because they do not meet the food hygiene and safety standards of the importers. In this context, traceability is widely recognized as essential to ensure that important food safety standards are met. Using transparency as a foundation, supply chain traceability allows organizations and the government to access critical information about the origins of raw materials or a finished product. Organizations and government can also obtain information about the production processes that raw materials and finished products have undergone (Francisco & Swanson, 2018).

At the moment, the existing traceability systems for fishery products in developing countries like Vietnam are inadequate and seemingly far outstripped by those in developed countries. This issue has resulted in discussion about whether the applications of advanced technologies such as blockchain could actually narrow the food quality gaps in developing countries (Tan & Ngan, 2020). As Woodside et al. (2017) have stated, blockchain is an emerging technology that is expected to transform businesses across different industries. One promising feature of blockchain is to provide transparency, which supports traceability in ways that older technologies cannot.

Given the potential of blockchain application in the traceability of Vietnam's fishery logistics and supply chain management, as well as the future application of blockchain to international trade, the authors have decided to research on the topic: "The use of Blockchain in Vietnam's global fishery supply chain management". The focus of this study is to explain whether the applications of blockchain could increase the quality of Vietnam's fish exports, and how the use of blockchain can improve traceability and transparency in Vietnam's fishery logistics.

This research provides an assessment of the relevant contemporary literature to better understand how blockchain technologies can be used to manage Vietnam's global fishery supply chains. From our examinations of the empirical literature, we found that while most studies use a variety of empirical approaches to analyze supply chain management practices, more can be done to address Vietnam's seafood industry development and the way in which technology can be used to manage relevant supply chains. Our analysis provides a series of relevant policy recommendations and areas of future research endeavor. In particular, a more detailed evaluation of the feasibility of the blockchain-based traceability system is needed as efforts to design a better mechanism for introducing new pilot applications.

4.2 Literature Review

Most countries have engaged in blockchain technology research and development. Research on blockchain technology began after 2008, when Satoshi Nakamoto proposed the use of bitcoin – the first peer-to-peer digital currency (Nakamoto, 2008). In later years, due to the huge influence of bitcoin, blockchain gained widespread attention from both academia and policymakers. A White Paper on Blockchain in Trade Facilitation by the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT, 2019) and a study on the Distributed Ledger Technology (DLT) and Blockchain (2017) by the World Bank do much to explain the concept, advantages, and operation methods of blockchain platforms. They also detail areas of possible applications, such as: currency, payment, securities, insurance, and other non-financial fields, including global logistics and supply chain.

The adoption of technology and the availability of innovative solutions in the logistics and supply chain sector industry have evolved over the past 15 years, mainly focusing on the traceability and transparency of data. According to Bateman (2015, p. 8), traceability "affects supply chain efficiency, product safety and security, managing deep tier risks, on-time delivery performance, troubleshooting customer issues, controlling costs, and regulatory compliance". The world has witnessed many lost, damaged, or delayed shipments, the consequence of which is decrease of product quality. A main reason for the decrease in product quality is lack of transparency and central control. Other reasons include miscommunication between vendors and suppliers, as well as confusion in the supply chain. In the food industry, according to WHO (2017), every year around 600 million people (almost 1 in 10 people) in the world fall ill and 420,000 die by diseases due to the consumption of contaminated food. One of the reasons is that foods are not manufactured, processed, transported, and stored safely.

Therefore, for years, many research papers have been conducted to find out the solution to the problem of traceability. Multiple approaches to supply chain traceability have been applied, ranging from traditional paper-based ones to sophisticated and advanced technologies. In 2015, Alexis H. Bateman drew attention to a new system called blockchain-based supply chain traceability system. Francisco and Swanson (2018) agree with Alexis H. Bateman's suggestion that the characteristics of blockchains indeed make them especially suited for traceability applications. Christidis and Devetsikiotis (2016) state that blockchain is considered to be a good solution for connecting and managing Internet of Things (IoT) objects. A large amount of such objects is found in a logistics environment (vehicles, shipments, etc.), The IoT is one of the most promising fields of application. By integrating the IoT with blockchain, Madakam et al. (2015) indicate that the efficiency of the food traceability system can be improved to build an open and comprehensive network of devices that can automatically organize and share resources and data. In recent years, blockchain applications have been developed, such as a project to track the origin of fish by a UK-based company named Provenance, or the development of traceability solutions for pork in China and for mangos in the US by Walmart and IBM (Kamath, 2018).

Hofmann and Rüsch (2017) suggest that the application of blockchain will help facilitate further supply chain integration. In order to facilitate progress, government policies are adopted around the world to support digital technology development. Focusing on the fishery logistics and supply chain management of Vietnam – where the standards are mainly based on the ISO standards – this paper also recognizes the occurrence of the blockchain concept in several ISO standards, such as ISO 22739:2020. These standards define basic terms relating to blockchain and distributed ledger technologies. ISO 22005:2007 provides general principles and basic requirements for the design and implementation for a feed and food traceability system.

Francisco and Swanson (2018) argue that industries and firms that are already well developed may not be willing to invest in blockchain if the innovation does not provide significant benefits over existing solutions. They continue to share that, according to the United Nations Global Compact on Traceability (2014), some companies with a profound understanding of their supply chains and supply chain partners prefer to have their own traceability protocols. In industries such as agriculture or manufacturing, which present a wide and diverse multi-stakeholder framework, several traceability protocols already exist to develop a stable and trustworthy chain of product custody standards and certification. Besides, according to Bello et al. (2005), less developed countries still have the tendency to trace product in supply chains by a paper-based approach or, as Wognum et al. (2011) state, by leveraging their integrated system to avoid overspending rather than exploiting cutting-edge techniques.

Nguyen et al. (2020) argue that although there have been quite a few system applications for the traceability of pork or agricultural products in Vietnam, most of these systems involve using QR code or bar code with lots of limitations. These limitations include: data that is impossible to be reused; data that is short in reading range and scope; data that is highly environmentally sensitive; data security is weak; and especially, traceability applications have not yet been applied to seafood traceability. Most Vietnamese fishermen and farmers are not familiar even with recording documents and exchanging them with wholesalers who buy their products, let alone participating in a complex computer-based system. The number of studies on seafood traceability in Vietnams is still relatively small, and most of them are about overall supply chain management. They do not focus on traceability, information security, or export financing, etc.

Much is still yet to be learned about blockchain, but as Zheng et al. (2017) argue, it is undeniable that blockchain has much potential to become a realistic technological option to address the challenge of transparency across the supply chain. With the help of blockchain, the systems can be made completely "end-to-end" with information tracked going far beyond origin of products, which can include data on storage temperatures, shipping details, batch number and so on.

4.3 Background Information

4.3.1 Fishery Logistics and Supply Chain of Vietnam

In the structure of Vietnam's export market, seafood is one of the key commodities that actively contribute to the growth of export turnover. Indeed, Vietnam is the third major exporting country of aquaculture products, with exports worth $8.89 billion in 2021 (Fig. 4.1) and a high export rate of major fishery products (shrimp, pangasius and tuna) to the world's top markets such as the US, EU, and Japan (Table 4.1).

Currently, the value-add to Vietnam's fishery products is low and Vietnam's fish export trade is affected by issues of quality. In 2017, Vietnam was issued a yellow card by the European Union (EU) related to Illegal, Unreported and Unregulated Fishing – IUU, which led to a decrease in efficiency, export value and market share. From being the then 2nd biggest import market of Vietnamese fishery products, the EU quickly dropped to the 5th position, entailing a great impact on Vietnam's seafood reputation and trading volume to other markets.

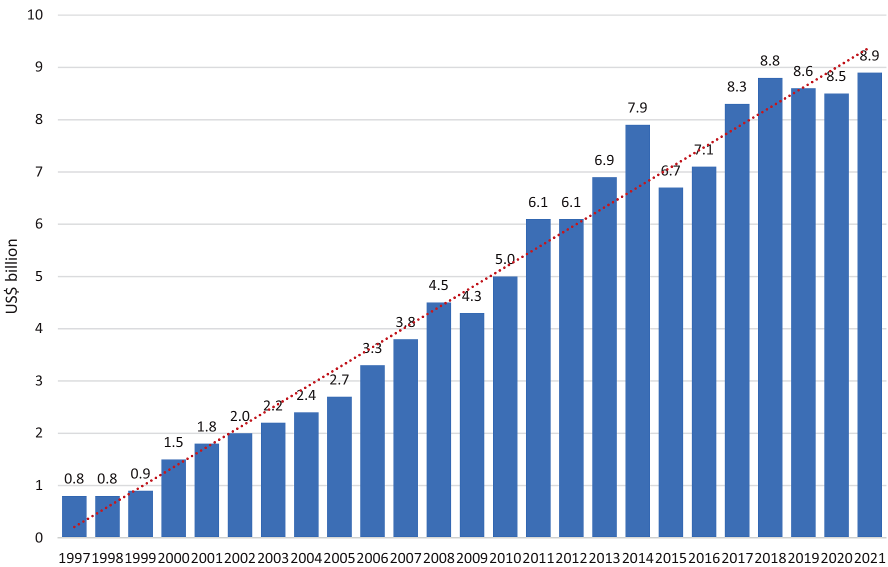

Fig. 4.1 Vietnam seafood exports, 1997–2020. Source: Fishery profile – Vietnam Association of Seafood Exporters and Producers (VASEP)

Table 4.1 Top 10 single markets importing Vietnamese seafood in 2020–2021 (US$ mil)

Markets	2020	2021	Change (%)	Proportion (%)
The US	1620.629	2049.359	26.5	23.0
Japan	1422.252	1325.597	−6.8	14.9
China	1,203,234	990.648	−17.7	11.1
South Korea	768.518	807.785	5.1	9.1
The UK	344.638	316.137	−8.3	3.6
Thailand	244.357	267.034	9.3	3.0
Canada	262.760	265.618	1.1	3.0
Australia	228.202	265.457	16.3	3.0
Netherland	219.382	228.085	4.0	2.6
Germany	180.010	200.052	11.1	2.2

Source: Report on Vietnam's seafood exports in 2021, Vietnam Association of Seafood Exporters and Producers

In addition, according to the United Nations Industrial Development Organization (2019), Vietnam is one of the top three countries that received the most cases of import rejection regarding fish and aquatic products from four major importers: the EU, the US, Japan, and Australia, from which Vietnam accrued annual financial losses (in the study period) up to 14 million USD. The main reason for such import rejection is Vietnam's weak management regarding Sanitary and Phytosanitary Measures (SPS) in all stages of the fishery value chain. Poor quality control during fish farming, fish processing and delivering leads to problems such as: veterinary drug residues (EU market), hygiene and labeling conditions (US market), industrial contaminants and foreign objects (Japan market). Hygiene problems can occur at any stage from the point of origin to the point of distribution. In order to reduce the rate of import rejection, logistics and supply chain companies need to adopt a comprehensive solution for better control and management of all stages in the value chain.

The Vietnamese seafood sector is under pressure. There is a continuous use of fishing equipment and methods that destroy original resources, such as explosives, electric pulses, trawling nets, small fish catching, fishing in coastal waters or marine protected areas, etc. In addition, spontaneous and sporadic aquaculture farming caused serious damage to the environment. At the same time, in order to maximize profit, many fish breeding establishments used hormones to stimulate reproduction, leading to the deterioration of fingerlings quality to an alarming level. Signs of deterioration included a lower survival rate, and the increased probability of a higher rate of infection, leading to disease.

Adopting blockchain technology to build a traceability system is essential to facilitate supply chain management and tracking. Such tracking extends from any given point in the supply chain backwards to the origin of seafood with blockchain allows for the strict control of off-shore fishing and effective monitoring of aquaculture. As a result of applying blockchain, Vietnam will be able to provide efficient decision-making that would improve the seafood value chain and enhance the reputation and brand name of the Vietnamese seafood industry in the world market.

4.3.2 What Is Blockchain Technology?

In the simplest terms, "blockchain" is a chain of blocks that are connected by cryptography, an information security technique (Hans & Rhea, 2021). The original idea of blockchain technology came from the development of cryptography in which encryption methods were invented to convert comprehensible messages into incomprehensible forms. Encrypted data could only be read by a small number of people who created and agreed to use a decryption key (Rouse, 2020). Over time, this technique was applied to digital and computing data and to secure information on the internet, especially in Blockchain technology.

Blockchain was assumed to be invented firstly in 2008 in a paper named "Bitcoin: A Peer-To-Peer Electronic Cash System" by an unknown person, or a group of people, using the name Satoshi Nakamoto, for the purpose of creating the cryptocurrency bitcoin. This was "the first digital currency that solved the double-spending problem without the need of a trusted authority or central server" (Nakamoto, 2008).

According to Nakamoto, a blockchain is a distributed ledger that is completely open to anyone. A block is a piece of digital information that can store up to 1 megabyte (MB) data, which once recorded inside the blockchain, becomes very difficult to change. Each block contains data, the hash of the block and the hash of the previous block (Doruk, 2022). These data stored in the block could be the transaction details (date, time, amount), transaction parties (each party is recorded under a unique identity, called digital signature or username), and special information to distinguish it from other blocks.

The hash of the block is just like a fingerprint that can be used to identify a block and all of its contents. Once a block is created, its hash will be calculated and when some data inside the blocks is changed, all of the hash changes will be updated as well. The hash of the previous block that is stored inside of each block connects blocks and makes a blockchain. As someone tampering with one block of the chain will cause the hash of that block to change as well, this action makes all the following blocks invalid because they are no longer storing a valid hash of the previous block (Haque & Rahman, 2020).

Another element of blockchain is the proof-of-work mechanism that slows down the creation of new blocks. This mechanism makes it very hard to tamper with the blocks, because if you tamper with a block, you will need to recalculate the proof-of-work for all the following blocks. Moreover, blockchain assures a high-level of security is achieved along the peer-to-peer network. All the nodes in this network create consensus, which agree about which blocks are valid and which are not, for example, blocks that are tampered with will be rejected by other nodes in the network. To successfully tamper with a blockchain, someone needs to tamper with all the blocks on the chain, redo the proof-of-work for each block, and take control of more than 50% of the peer-to-peer network (EdifyPath, 2022). Only then will that tampered block be accepted by everyone else. Given this context, blockchain technologies are therefore extremely secure methods of data storage.

In short, with the above-mentioned operating mechanism, blockchain is able to provide outstanding features and advantages such as: Data preservation, transparency, immutability, intermediaries' elimination, reducing transaction time and costs, and high verifiability. These features create a basis for determining ownership. Blockchain applications are also constantly evolving, with one of the more recent developments in blockchain applications is the creation of smart contracts. In a simple way, blockchain can be applied in almost every activity in our daily life and sectors in international trade.

4.4 Blockchain Application in Vietnam's Fishery Logistics and Supply Chain Management

4.4.1 Potential Application of Blockchain in Fishery Logistics and Supply Chain Management

As discussed, blockchain offering enormous potential, acting as a new means of improving the processes and business models of the fishery sector and in particular its logistics and supply chain management. There are three blockchain-based innovations that offer the most benefits when adopted. These are: (i) verifying goods; (ii) reducing paperwork and cost; and (iii) end-to-end tracking. Blockchain applications in logistics are expected to provide a relative advantage as they provide features such as immutability, transparency, and decentralization.

Firstly, blockchain technology can effectively be used to create a digital certificate for each piece of fish, tracking from the moment they are caught or processed, to when they end up in the hands of customers. If contamination is detected, products can be traced back to their roots, and the person who detects contamination can instantly notify other people who bought the same batch of bad food. Such a system can also battle counterfeit goods by allowing anyone to verify whether or not the product comes from the manufacturer they think it does. By being able to share information and to prove to consumers that their products originate from safe and sustainable producers, producers can develop more loyal customer bases and in doing so grow the profitability of their business (Luh et al., 2020).

Secondly, global fishery supply chains normally contain verifying documentation in the form of letters of credit or bills of lading. As these letters are actually moving across time and space and involving multiple actors, they face the risk of forgery, theft, and alteration (Lehmacher, 2017). Kim and Laskowski (2018) highlight that blockchain creates access to crucial data since the information is stored across several computers, providing a secure, duplicated, and synchronized ledger, such as digital bills of lading "which cannot be secretly altered […] because the original is always visible" (Morley, 2017). Deploying blockchain solutions can significantly reduce the chance to manipulate an item as information in the blockchain cannot be changed. Besides, digital bills of lading also facilitate a speeding up of current processes and lead to a reduction in cost, as they allow for the elimination or reduction of paperwork associated with today's business practices (Hackius & Petersen, 2017). An adoption of blockchain technology would improve the management of the current cumbersome administrative paperwork, as consignment validation and control process are time-consuming and possibly affected by human error. More importantly, smart contracts can provide advantages as they might eliminate or substantially reduce transaction costs through the recording and auditing functions of the blockchain, as well as executing payments automatically.

Thirdly, the ability to trace the origins of goods or to gain more knowledge about them in the current logistics system is rather limited (Yang & Lirn, 2017). Although current practices have the ability to track the shipment of a package through the company's internal tracking system on their home page, the information is often limited to timestamps of when the package enters the logistics service provider's handling system (Shermin, 2017). With one of the more recent developments of blockchain, which is the creation of smart contracts, the technology provides a secure platform for actors to not only follow the movements throughout the supply chain, but also share and exchange information concerning their delivery, package, and shipments. Data can also be allowed to be automatically exchanged based on certain conditions (such as only sharing the data a partner wants to reveal). Similarly, the awareness of environmental impact stemming from fishing and freight has increased and logistics providers have introduced sustainable options. However, the various layers of subcontractors involved in typical processes make it difficult to verify environmentally friendly standards. By having such information on the blockchain, customers would be able to trace the goods back to the first node in the chain of fishing to transport, providing insight into the chosen fishing method, transport route and carrier choice (Dobrovnik et al., 2018).

However, there are still risks associated with adopting this technology, particularly in the field of logistics and supply chain management. Logistics and supply chain are not only huge but also complex. On the other hand, blockchain is still in the nascent stages of development, with relatively few designers familiar with the technology. This can make implementation complex and costly.

4.4.2 A Framework for Adopting Blockchain to the Vietnam's Fishery Logistics and Supply Chain Management

Based on recent studies, the authors would like to summarize a structure that emphasizes blockchain-based quality traceability to improve transparency and security of transaction information throughout the process of Vietnam's fishery logistics and supply chain management:

(i) *Business practice stage:*

This stage consists of a business cycle for the entire seafood supply chain. At present, there are two common types of seafood suppliers: fresh seafood and processed seafood. A fresh seafood supply chain includes multiple stages: Purchasing input materials (fish seeds), farming, catching, transporting, preserving, distributing, or exporting and finally reaching the consumer. A similar concept is applied to the processed seafood products supply chain, with the only additional processing stage occurring after seafood is purchased and before distribution or export. Each of such connections inside the supply chain can be exploited for the purpose of controlling and managing traceability information for seafood products.

Traceability can begin during the collection of raw fish. After being caught or processed, the seafood is then packaged and labelled with identifiable tags such as barcodes, QR codes, RFID tag readers,[1] NFC-connected devices,[2] etc., before being registered into the system as new products (Giang & Trang, 2020). From here, all the information of such product can be stored into the product's database. The data for the corresponding fish seeds, including breed, feeds and health will in turn then be updated on the blockchain, which makes it very difficult to tamper with the information. If any package is not able to meet the initial requirements it is rejected by fish collectors. At this point, the farmer is then able to identify the exact batch of fish that has been rejected by scanning the tag on the returned package. In order to have common and consistent data standards, producers should operate in a manner that is in accordance with the World Trade Organization's SPS and TBT regulations such as: GlobalGAP, Hazard Analysis Critical Control Point (HACCP) and ISO standards. In this way, related information on catching or processing procedures can be traced back and understood with the help of identifiable tags and blockchain, such as whether the fish breed is healthy, who was the person performing the fish catch for this batch of fish, which catching machine was used, if storage equipment was cleaned correctly, etc. Meanwhile, with a new identifiable security seal attached, fish collectors can use blockchain technology to upload all pertinent information onto the distributed ledger, such as the fish batch number, collecting time and location, original farms, total volume, initial test results and transportation vehicle details (Tan & Ngan, 2020).

(ii) *Internet of Things stage:*

Information for each of the supply chain linkages can be traced back to its direct origins, including quality information, logistics information, and transaction data. After receiving the seafood, the processing/consuming agent can then read and register the new data into the product's profile, once again through identification technologies (barcode, QR code, RFID, NFC, etc.) that can automatically and

[1] Radio frequency identification reader (RFID reader): a device used to gather information from an RFID tag, which is used to track individual objects.

[2] Near Field Communication (NFC) technology allows users to make secure transactions, exchange digital content, and connect electronic devices with a touch.

continuously collect and transmit ambient information about weather, humidity, oxygen, CO2, etc. (Giang & Trang, 2020). After processing, new tags/labels continue to be attached to the handled/processed products. These connected devices can then easily communicate with the ledger in the blockchain (Giang & Trang, 2020).

In the next stage, the fresh seafood/processed seafood are preserved at the storage facility. Through the installation of IoT devices inside the warehouse, the data of the registered seafood can be automatically extracted. For example, with wireless sensors and monitoring devices, seafood data including quantity, category, temperature, humindity and storage time can be stored in real-time, which then can be checked and updated in both of the digitized database and on the product's labels/tags (Giang & Trang, 2020).

Inventory information can also be queried directly inside the system or by means of an RFID reader which can also meet the requirements for dynamic storage management (Giang & Trang, 2020). In the next stage of distribution, factors around hygiene, safety and the quality of the seafood can be determined using the 3 T factors (Time, Temperature and Turbulence). Moreover, one of the options is to design and install a sensor system at different spots on the transporting vehicle to monitor the quality of seafood by collecting real-time data on humidity, temperature, and seafood preservation environment, and then sending this information to a digitized database where the goods can be tagged and labelled.

(iii) *Blockchain stage:*

Smart contracts are helpful in supporting real-time monitoring and providing quality control check for each block. With logistics data, smart contracts are even able to automate logistics planning (Kshetri, 2018), such as to automate transactions between farmers and manufacturers or between exporter and importer. When the blockchain layer combines with the IoT layer, smart contracts will get even "smarter", as the application of blockchain can be further exploited in the IoT environment – such as when the automated payments between systems (when two systems are interconnected, they can start negotiating and applying prices based on the logistics operational efficiency) (Giang & Trang, 2020).

The distributed ledger system will assist retailers and consumers in storing transaction information, and increase transparency of information throughout the product's flows, from producer to processor, to distributors, importers, and supermarkets/markets/retail shops, etc., and finally consumers (Giang & Trang, 2020).

(iv) *Application stage:*

This final stage allows for the smooth interaction between actors in the seafood traceability chain and the blockchain system. The actors participating in the chain can review the entire product flow, information flows and financial flows through the distributed ledger system. Data related to quality management, price management, financial management and sales management can all be continuously updated into the blockchain. Ultimately, the end consumers can use their smartphone to scan the product QR code at the Point of Sale (POS) and check its provenance as well as authenticity (Tan & Ngan, 2020). They will be redirected to a webpage containing information that could answer some of the questions about a particular fish item such as: the original farm or the processor of the fish product, the time of manufacturing, the processing stages, the food safety standards, the date and time of distribution and display, and the expiration date, etc.

4.5 Transformation Phases of Blockchain Application for Vietnam's Small and Medium Enterprises

Once a company recognizes the potential of blockchain technology to drive efficiency and value, the next step is to establish an application roadmap. This should start from a willingness to collaborate, involving building blockchain knowledge and capabilities with a focus on driving value for all stakeholders. There are three main success factors for every blockchain initiative: (i) Create a culture of collaboration; (ii) Build up blockchain knowledge and capabilities; and (iii) Focus on value and engage with stakeholders on blockchain opportunities (Heutger & Kueckelhaus, 2018).

According to Iansiti and Lakhani (2017), the use of blockchain applications will happen in different transformation stages and will require different levels of collaboration and consensus, as well as legislative and regulatory efforts. Moreover, organizational processes, capabilities, capital, and infrastructure have to be established in order to facilitate the implementation of these blockchain applications. The below framework created with reference from Iansiti and Lakhani (2017) can help managers of SMEs in different development stages to identify suitable business opportunities and corresponding starting points in the supply of seafood.

Phase #1 – The Planning This phase builds toward a prototype for the proof of concept. During the proof-of-concept phase, stakeholders should learn all the nuances of using blockchain technology in the proposed application.

Phase #2 – Approaching and Experiment For most small and medium logistics companies, the best way to start on blockchain is to adopt blockchain gradually case by case, which minimizes risk because stakeholders can test the application on a small scale based on existing systems. Gradual adoption involves little coordination with third parties while permitting a high-level assessment of roll out at scale. Another low-risk approach is to use the blockchain internally as a database that manages the physical and digital assets, recording internal transactions, and verifying identities (Heutger & Kueckelhaus, 2018).

Phase #3 – Localization This is the phase where logistics companies can tackle specific problems in the area of transactions across boundaries by using blockchain to digitize paper records so that the global network of shippers, carriers, ports, and customs authorities are connected (Dobrovnik et al., 2018). First result of the established platform is when every relevant document or approval is stored on the blockchain, with every partner having full visibility of the container (Allison, 2017).

Phase #4 – Substitution Developing substitute applications requires careful planning and a shift of perspective – from achieving success with an internal solution to now onboarding multiple parties and testing the solution across a network. One path to follow could be to focus on replacements that do not require end users to significantly change their behavior but presents alternatives to expensive or unattractive solutions in a way so that it is not difficult for the ecosystem to absorb and adopt.

Phase #5 – Transformation Transformative applications may require departure of value and business operation logics from existing approaches. These applications are, however, argued by Iansiti and Lakhani (2017) to be "many years away". They have, however, the potential to unlock future growth for companies. A transformative blockchain business model involves scaling the solution which, in turn, requires a transformation of business processes and depends heavily on their acceptance across internal parties and multiple stakeholders and even business partners (Dobrovnik et al., 2018). Stakeholder participation is arguably the most critical success factor in blockchain adoption, as the success of the project hinges on everyone adjusting their business practices and fully leveraging the blockchain implementation. In 2020, Walmart decided to improve the last mile deliveries through coordinating delivery drones using the blockchain. Whether this strategy has succeeded remains controversial. Moreover, it is argued that the current Internet architecture with its server infrastructure might not be able to handle such a number of devices and data, which also entails a large number of data security concerns.

4.6 Current Situation in Vietnam & Some Policy Recommendations

4.6.1 Current Situation of Blockchain Adoption and Management in Vietnam

While many countries around the world have been deploying multiple application models of IoT, artificial intelligence, and blockchain technology platforms in order to build a digital economy, in Vietnam, those technologies are still brand-new fields (Giang & Trang, 2020). Predicting the rapid development trend of digital technology, Vietnamese government has adopted several legal amendments to resolve existing problems. An orientation for technology development in the period 2021–2030 was introduced: "Application and development of new technologies, prioritizing digital technology, 5G and post 5G connectivity, artificial intelligence, blockchain, 3D printing, Internet of Things, cybersecurity, clean energy, environmental technology to transform and improve energy productivity and efficiency of the economy". Many laws and legal documents related to information technology have also been promulgated.

Nevertheless, the factors of technological innovation and education that are ready for Vietnam's 4.0 industrial revolution stays measured at a low level – total 4.9 point out of 10 (World Economic Forum, 2018). Not only those regulatory efforts are not comprehensive and up to date, the absence of a central authority as well as a censorship authority for the current blockchain system has the potential to, according to Reyna et al. (2018), create a lot of instability. Report No. 70/BC-BTP dated March 23, 2020 submitted by Vietnam's Ministry of Justice to the Prime Minister made representations about the legal framework related to the application and development of services and products based on blockchain platforms. The report found that in relation to seafood traceability using blockchain alone, many businesses stated that they basically do not have any problems with their existing system. According to these businesses, in order to build a traceability chain using blockchain, the most important factor is to develop an ecosystem friendly to the application of blockchain where publicity, transparency and anti-fraud practices are nurtured.

4.6.2 Some Policy Recommendations for the Vietnamese Government

First and foremost, governance and monitoring of the development of blockchain are the fundamental factors that should be identified as a long-term goal, requiring the government's considerable investment in a comprehensive legal framework regulating the automation and digitization of procedures related to business operations.

(i) In this blockchain application journey, the "standardization of production" will be the most difficult problem for Vietnamese businesses as now all input issues such as the use of seeds, feeds, medicines, or vaccines will be exposed. Therefore, it is necessary for the regulatory authority to be involved in the implementation of related plans as well as to assist businesses by providing multiple blockchain standard guidelines for farmers to follow.

(ii) The government needs to create a complete and consistent legal framework for the management of blockchain-related transactions to identify and support legitimate real-life applications of blockchain, such as cross-sector digital databases, the problem of data sharing, information security, personal data protection, privacy protection, e-authentication, etc. Regarding this issue, Vietnam should refer to the best practice of other countries that are ahead of the curve in digital technology regulatory adoption, such as those on protection of personal data and privacy of users of Singapore or Malaysia. Moreover, the use of Electronic Identification, Authentication and Trust Service (eIDAS) Regulation of the European Union (EU), or the Electronic Signatures in Global and Nation Commerce Act as are used in US may also be of benefit. Many governments have also introduced regulations on sharing banking data or a controlled trial management mechanism such as the Financial Conduct Authority (FCA) of the UK, or the Monetary Authority of Singapore (MAS), etc.

(iii) In addition, government authorities and state-owned enterprises should pioneer the application of scientific and technological systems, including blockchain technology. This workstream not only serves the purposes of improving the efficiency of administration, governance, and provision of public services, but also taking the lead in building a blockchain ecological environment. After a blockchain environment is built, the ability to connect relevant stakeholders into the ecosystem could be more easily achieved. Nevertheless, while an optimal environment for innovation is created, it is necessary to ensure the neutrality of technology development in the direction that the market decides on technology selection. The current legal framework should be flexible in managing and handling related issues. Exceptions should always be allowed, and the government should react in a quick manner if any arising issue (or issue groups) requires a regulatory amendment.

(iv) To create a competitive yet united blockchain ecosystem that attracts more participants from the private sector, it is also necessary to develop policies that support businesses – especially the SME groups – not only in terms of operations and processes, but also financially. Examples include policies that seek to cut taxes, and provide financial support by way of loans, etc. Vietnam can first develop these supportive policies for a group of pioneering enterprises, thereby creating a competitive environment for other businesses as well as other actors of the economy to take advantage of and go for the general growth acceleration.

(v) At the same time, it is necessary to maintain strong effective relationships between the business community and those working in technology service sector – both domestically and internationally. The ability to do so promotes not only the exchange of knowledge and technology, but also helps to handle any problems and difficulties that may arise during the process of implementation. Capacity and quick adaptation to the system can also be improved by the increase of understanding and awareness of people, businesses, and enterprises, which can be achieved through means of communication, dissemination, training, and retraining activities.

4.7 Conclusion

This study revealed valuable insights and potential benefits of blockchain adoption in Vietnam's fishery logistics and supply chain management system. The study also proposes a model framework for blockchain application in tracing the origins of seafood in the sector, as well as requirements for Vietnam's trade policy to build a suitable blockchain model. The immutable nature of blockchain will help tracing products from the point-of-producer to the point-of-customer, and allow anyone to check if the system has been compromised somewhere, or not. Transparency in the blockchain reduces delays and disputes while preventing fishery products from getting stuck at any stage of the supply chain. Since each product can be tracked in real time, errors are also kept to a minimum. In addition to the guarantee in product integrity, as well as the efforts to combat poor quality seafood products that do not meet the requirements of importers, blockchain technology can also help retailers and small businesses overcome the financial problems that they are facing in the global logistics and supply chain.

The development of application models for seafood traceability is not new in the world, but the application of blockchain technology in seafood traceability in Vietnam is still a challenging field due to short-comings in the production and distribution of fish in Vietnam. Therefore, future studies can aim to adjust and evaluate the feasibility of a blockchain-based traceability system, or even consider blockchain technology applications to enhance the sustainability of other products' logistics supply chains as well, such as those involved with agricultural and medical products, etc.

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