Model of e-supply chain by Adopting Block Chain Technology in Salt SMEs in Indonesia

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Abstract

Salt is one of the national strategic comodities that has an important position in Indonesia. It is, among others, the basic needs of society and also for industry. In the field reality, the number of data on the production process and supply chain of salt processing is massive. Up to now, data on salt production and supply chain flow have not been wellrecorded . Therefore, it is difficult to evaluate the total amount of salt production in Indonesia. Salt farmers gain lack of information about opportunities to choose the middlemen or the factories that can provide competitive prices. It is the time for salt farmers to utilize a digital system to carry out salt sales activities from their land. The reactivation and recovery program for Small Medium Enterprises (SMEs) by the Indonesian government in assisting SME through digital transformation programs needs to be supported. The purpose of this paper is to develop a conceptual model of digital supply chain system to help salt farmers adopt and utilize digital systems more easily. This far, there is no research that discusses the e-supply chain system with block chain technology in the salt business yet. For this reason, the model are expected to contribute to share knowledge about a new supply chain system that can be adopted by salt farmers.

Keywords: : e-supply chain, blockchain, salt, Small and medium enterprises (SMEs)

1. Introduction

The digitalization system of supply chain process is needed in the current new normal era. Almost all economic activities are performed by applying information technology. The operational activities of the manufacturing industry starting from planning the production process, manufacturing process, finance, human resources and marketing will be more effective by utilizing digital systems. Each entrepreneur or entrepreneur is advised to recognize and apply technology in their business activities.

As one of the national strategic commodities in Indonesia, salt has an important position to rely on. Salt is not only the basic needs for the society but also for the industry. Indonesia does not have a comparative and competitive power to produce salt because of the unsupportable climate and the low development of innovation in the salt industry ((Herman, 2014). Salt farmers' profits are highly dependent on sales results and the supply chain system (Maflahah, Wirjodirdjo and Karningsih, 2020b).

The role of the middlemen is very much influencing in determining the price of salt at harvest. Salt sales transactions depend on the characteristics of farmers, the quality of salt harvests, the amount of harvest, and access to markets, transaction processes and costs, salt prices, and the availability of information about salt price fluctuations (Maflahah, Wirjodirdjo and Karningsih, 2020a)). Several regions in Indonesia have formed salt cooperatives that help farmers to sell their harvest so that they get a decent selling price of salt. The management of the cooperative is runned by a traditional management system so that there are limitations in the process of information flow and transparency of salt buying and selling transactions from cooperative members to the salt industry or middlemen (Rinardi and Rochwulaningsih, 2017).

The data on the production process and supply chain of salt processing is profound. However, the data on salt production and supply chain flow are not wellrecorded. Therefore, it is difficult to evaluate the real number of total salt productions in Indonesia The salt farmers are lack information about the opportunity to choose the middlemen or the factories that can provide competitive prices. Thus, digital transformation is needed to help salt farmers make decisions in the process of selling salt.

It is the time for salt farmers to use a digital system to manage their salt sales activities. But in general, micro-enterprises have several problems in adopting digital technology. Among them are lack of capital, lack of capability, lack of human resources, and limitations in the technical field (Chen *et al.*, 2021). The MSME reactivation and recovery program by the Indonesian government in helping MSME through digital transformation programs need to be supported. The focus of the program is on forming an optimal supply chain system to help salt farmers adopt and utilize digital systems more easily. Up to now, there is no research that discusses the e-supply chain system with the block chain concept in the salt business. This study proposes model of e-supply chain by adopting Blockchain technology in Salt SMEs. The results of this study are expected to contribute to share knowledge about a new supply chain system that can be adopted by salt farmers.

2. Literature Review

The Internet and technological developments today have changed the way organizations live and work. Technological developments also have an impact on the opportunity to develop new electronic supply chain management (e-SCM) systems. The e-supply chain system helps aligning and integrating activities, functions and applications between stakeholders in the supply chain system.

Research on the e-supply chain based on a website has been carried out by Perbangsa (Perbangsa *et al.*, 2018). However, the results of this study discuss the supply chain flow in the large-scale salt industry. There is no research that discusses the supply chain in smallholder salt businesses or salt farmers. Based on the situations, this research develops an e-supply chain system that is adapted to the conditions of information flow and salt products in Indonesia. The definition of e-supply chain in this study is the use of the internet in managing collaboration systems between stakeholders in the supply chain with the aim of increasing the efficiency and effectiveness of cooperation and product, information and financial flows in the supply chain network (Pulevska-Ivanovska and Kaleshovska, 2013).

Previous studies discover that there are obstacles in the process of adopting digital technology in small and medium enterprises, including the SME managers who are not able to apply information technology, limited funds, limited infrastructure facilities, and lack of motivation to manage or organize data and information on supply chain transaction processes (Hoogendoorn, van der Zwan and Thurik, 2019; Chouki *et al.*, 2020). Data or information on product and financial flows should be used as a reference in determining the amount of stock, planning for salt production and storage, and determining market prices. Thus, appropriate strategies and methods of the supply chain system are needed namely the e-supply chain (Frohlich, 2002; Caputo *et al.*, 2004; Sánchez-Flores *et al.*, 2020; Cheung, Bell and Bhattacharjya, 2021; Deepu and Ravi, 2021).

The e-supply chain system currently developed by integrating the Internet of Things (IoT) and Blockchain (BC). It is an immutable, shared distributed ledger technology where all transactions are validated by all user members and every transaction can be tracked. This system enables a decentralized system in which all network members can interact securely, validate and store all transactions without requiring authority from third parties (Dutta *et al.*, 2020). Transactions with the BC system prioritize the transparency factor when compared to the traditional system (Ghode *et al.*, 2020).

The use of BC in various fields of study including Agriculture (Casado-Vara *et al.*, 2018) (Ronaghi, 2020), Fisheries (Larissa and Parung, 2021), Textile (Pal and Yasar, 2020) (Agrawal *et al.*, 2021), Automation (Nasurudeen Ahamed and Karthikeyan, 2020), Perishable food (Thakur and Breslin, 2020), Oli (Aslam *et al.*, 2021), Iron and steel (Yang *et al.*, 2019), mineral SCM (Calvão and Archer, 2021), Automotive industry (Kuhn, Funk and Franke, 2020)(Raj Kumar Reddy *et al.*, 2021), Maritime (Fu and Zhu, 2019)(Hvolby *et al.*, 2021), Enterprises system and operation management (Lohmer and Lasch, 2020) (Haddara, Norveel and Langseth, 2021)(Chen and Huang, 2021), Humanitarian SCM (Baharmand and Comes, 2019), Health SCM (Reda *et al.*, 2020), and B2B SCM (Lahkani *et al.*, 2020).

In integrating BC into the supply chain, it is necessary to collect data about the product supply flow process and information in the system. The advantages of using block chains include reducing fraud, errors, and delays as well as increasing transparency (Dietrich et al., 2021), accuracy, traceability, immutability and data validity for all actors in the supply chain (Azzi, Chamoun and Sokhn, 2019; Jardim *et al.*, 2021). These factors are the motivation for organizations to adopt blockchain (Flovik, Moudnib and Vassilakopoulou, 2021). Block chains are also expected to increase supply chain resilience (Min, 2019), shorten transaction processes and improve supply chain performance (Fosso Wamba, Queiroz and Trinchera, 2020).

Blockchain cannot record large amounts of information. Therefore it requires on-chain information storage from core ledger data and off-chain data storage required by smart contracts for verification and documentation (Kawaguchi, 2019). Data sharing in the form of ledger records between actors in the supply chain can be protected by the formation of smart contracts (Hofman, 2019; Philipp, Prause and Gerlitz, 2019). The concept of a smart contract is defined as “a computerized transaction protocol that executes the terms of a contract” (Szabo, 1996).

Blockchain integration with the Internet of Things (Rožman *et al.*, 2019) and big data can help to build a platform to utilize smart contracts easily. It enables a better integration of supply chain flows including information, physical, and financial flows on a global scale so that it can reduce the time and cost of reconciliation (Irannezhad, 2020). By combining BC and IoT, partners in exchanging business information gain new information in real-time with more precise and reliable information about key processes, events and product attributes, such as quality, performance and availability (Pal and Yasar, 2020). With this revolutionary technology, public as well as rural SMEs can increase the efficiency of their operations by removing unnecessary middlemen (Philipp, Prause and Gerlitz, 2019; Prause and Boevsky, 2019; Wong *et al.*, 2020).

BC technology can provide tools to support publicly viewable and secure transactions. However, due to the immutable nature of transactions on the blockchain, recipients do not get any refunds unless a new transaction is issued. The laws and regulations regarding the implementation of BC are still unclear, so it can lead to ambiguity which can cause confusion among consumers. Operational costs in BC implementation are still expensive (Behnke and Janssen, 2020; Dutta *et al.*, 2020; Härting *et al.*, 2020).

The advantage of the BC application for MSMEs or farmers is that they can transparently display the availability of their products and services to all markets. It makes them more autonomous and less dependent on brokers and middlemen (Prause and Boevsky, 2019). However, the adoption of BC technology in SMEs experience some obstacles (Dutta *et al.*, 2020). Several obstacles in the process of adopting BC to SMEs, including limited technological facilities, costs, labor skills, limited management capabilities, experiencing obstacles, market developments, and openness of transaction processes that may not be approved by all members in the supply chain. However, with the pressure in business competition, SMEs are expected to be able to adopt a block chain system with support from the government (Wong *et al.*, 2020; Jardim *et al.*, 2021). Trust between partners in the supply chain is very much needed if the system applies blockchain technology. The influence of social factors and motivation of organizational members, and the culture of a region also greatly affects the success of BC applications in the SCM system (Wamba and Queiroz, 2019).

3. Salt Supply Chain System by Adopting the Consortium Blockchain

The transaction flow process in the salt supply chain is almost the same as the supply chain in the agricultural sector (Maflahah, Wirjodirdjo and Karningsih, 2020b). Most of the salt fields are located in areas that are still difficult to reach by means of transportation. Farmers also have limited funds and infrastructure to distribute their salt. The existence of a small middleman helps farmers to sell their salt directly from the farmers' land. Small middleman provides means of transportation, such as truck to transport salt. However, this sales method does not give farmers the opportunity to determine the selling price of salt. The quality and price of salt is determined by small traders. The total proceeds from the sale of salt are calculated based on the capacity of the transportation equipment or truck. Figure 1 show the current Supply chain flow of salt.

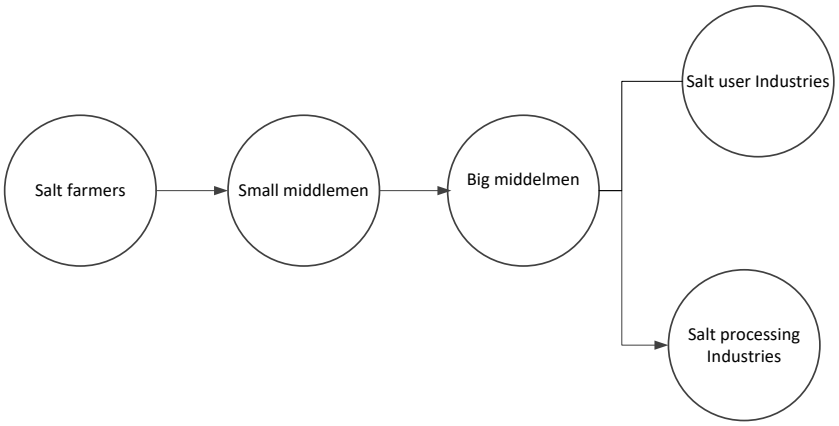

Figure 1. Current Supply chain flow of Salt

Larissa (Larissa and Parung, 2021) proposed an SC model with the adoption of BC technology in the fishing industry which is expected to be able to trace the origin of low-quality fish, as well as identify the costs needed to implement BC. References to the application of BC in the field of agricultural SC are still at an early stage. There is no real case study and it is still unclear how agricultural SC can take advantage of the economic and organizational benefits through the implementation of the BC platform (Mirabelli and Solina, 2020).

The Consortium Blockchain (CoB) is proper for BC application in salt SC in Indonesia. It is a semi-private system controlled by a group of users in various organizations (Uddin *et al.*, 2021). It can also be referred to as "local" BC with a focus on recording transactions in a flow in one of the most important process flows (Sund *et al.*, 2020). The BC application on the salt SC is appropriate to be applied to the transaction phase between the cooperative and the salt buyer. The transaction process can also be accessed by members of the cooperative. Thus it maintains the transparency of the sale of salt. Figure 2. shows the flow of the Salt supply chain by adopting CoB.

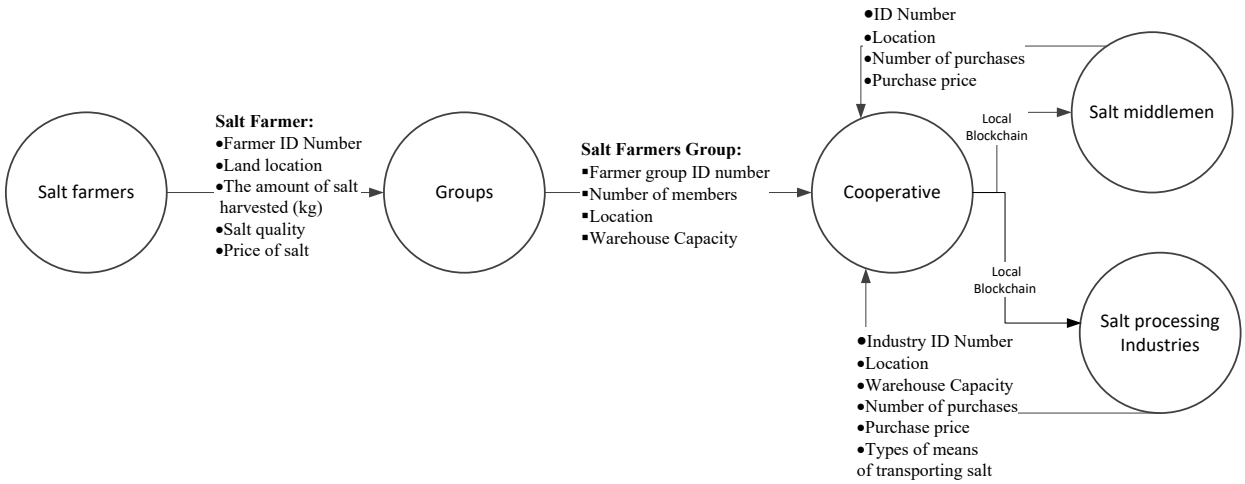

Figure 2. Salt Supply chain system by adopting Blockchain technology

The following is a more detailed explanation of the BC system in the salt SC:

1. Salt farmers input their special data such as ID and name, land location, quantity of harvested salt, salt quality, harvest period, and selling price of salt. The data will be stored in the system and connected directly to the database of the farmer group which is the home base. The data is also accessible by all members of the farmer group.
2. Farmers' groups collect all data from their members, which consist of goup ID and name, location of the office or warehouse, quantity of salt, warehouse capacity, and selling price of salt. The data is accessible by all group members, middlemen and salt industry.
3. The Salt Cooperative collects all data from its members consisting of group ID and name, office or warehouse location, quantity of salt, warehouse capacity, and selling price of salt. This data can be accessed by all group members, middlemen and the salt industry.
4. Salt middlemen input data like ID and name, location of the office or warehouse, means of transportation, and the bid price for the purchase of salt. Data from the middlemen is accessible by all farmers and farmer groups.
5. The Salt Industries shall input the ID and name, location of the office or warehouse, means of transportation, as well as the bid price for the purchase of salt. The data can also be accessed by all farmers and farmer groups.
6. Salt purchase transactions can be carried out directly by farmers to the middlemen or to the salt industry. It can also be done through farmer groups and cooperatives to the middlemen and the salt industry.
7. The scope of application of the block chain in the supply chain flow of salt is located on the flow of transactions between cooperatives and middlemen or with the salt processing industry. The initial phase of this system was formed to introduce the block chain system to members of the salt supply chain. Salt sales transactions from salt farmer groups to buyers (middlemen or industry) will be formed into blocks. In addition the transaction is broadcasted to all farmer members and sellers. Transactions must be validated by all actors and all involved in the salt sale process, stamped and stored. A new block is created and permanent, then the transaction is complete.

4. Model Validation

The model in Figure 1 is validated by using the face validity method by conducting an online Focus Group Discussion (FGD). Respondents in the validation process were three experts in the field of salt supply chain and information systems. Table 1 shows the results of the responses from the FGD.

Table 1 the results of the responses from the FGD

Evaluation to validate the conceptual model					
Category	Technique Used	Justification For Technique Used	Reference To Supporting Report	Result / Conclusion	Confidence In Result
Model Representation	Face Validity	o Very Weak o Weak o Neutral o ***Strong*** o Very Strong	o Very Weak o Weak o Neutral o ***Strong*** o Very Strong	o ***Valid*** o Invalid	o Very Weak o Weak o Neutral o ***Strong*** o Very Strong
Strengths	- The model offered is compatible with an open distributed ledger that can record transactions between two parties efficiently and can be verified and permanently - The suitability of the distributed method of the proposed model is managed with a peer-to-peer network distribution by following certain protocols for communication between nodes. Once recorded, the data in a block cannot be changed retroactively without changes to subsequent blocks. - Security concept (secure by design) the proposed model is a distributed computing system model with high Fault Tolerance (FT), this is indicated by member-based transaction access.				
Weaknesses	- The data type in the SC model needs to match the data types that are not supported in BC, so it is necessary to convert the data type. - The network distribution method in the proposed model is only peer to peer network distribution between nodes.				

5. Conclusion

The BC application on the salt supply chain has the prospect of being implemented. It is in the hope of helping improve the welfare of salt farmers through the sale of salt products at the highest price. Within the scope of salt sales transactions, the role of farmer groups and cooperatives is very important. The application of Local BC or CoB is suitable to be applied to the cycle of selling salt from farmer groups or cooperatives to the salt industry or middlemen or other buyers. The conceptual model that has been formed in this research can then be developed into an SC system platform by integrating BC and IoT.

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