

## A conceptual system for supply chain management: agricultural products distribution in Indonesia

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**ABSTRACT:** The agricultural sector in Indonesia face many problems, such as small-scale farming, minimum fund, the lack of technologies utilization, reliance on the season, limited access to credit loans, and market monopoly. This study will discuss a conceptual system which can provide access toward supply chain information in agriculture. This concept are offered to overcome the problems, particularly in terms of agricultural products local marketing and reducing market monopoly, by considering the requirement of three main parties: sellers, buyers and transportation carrier. The developed conceptual system is expected to become a basis for the development of an IT-based supply chain system that can accommodate the needs of the parties in the agricultural product supply chain system.

*Keywords:* Agricultural product, supply chain, distribution

### 1. INTRODUCTION

The agricultural sector plays a strategic role in the Indonesian economy. According to BPS in 2013, the number of farmers in Indonesia for food crops alone is around 20 million. However, the agricultural sector is still not able to show its full potential, it is seen from the level of welfare of farmers and their contribution to national income. This certainly is ironic because in general the economists argue that investing in agriculture sector is one of the solutions to reduce poverty, inequality and hunger [15]. There are some obstacles encountered in this sector, especially in Indonesia. Among them are small-scale farming, lack of capital, use of technology, relying on the season, limited market, the issue of financing, and the last, the monopolization of the market. In addition there are the problem relating specifically to the problems of distribution of agricultural products, some of them are, the price differences is high, long lines supply chain, profit margins are disproportionate and the difficulty of maintaining the quality and availability of products [20]. Studied in this research is the access to supply chain information that is expected to contribute to solving agricultural products market. In particular the relationship between sellers - intermediaries (distributors - transportation service providers) and the buyer.

In general, the actors in the supply chain in agriculture consists of suppliers, farmers, collectors, food processing industry, agents, resellers or retailers, and consumers [22]. If one party does not have enough information then the choice and decisions that can be taken is limited. Vice versa, a good information provides an opportunity for a party to get the best options that will ultimately improve the productivity and welfare.

Information required by each party in the supply chain in agriculture is very diverse, including but not limited to product information from suppliers such as fertilizers, farm equipment, agricultural products information, information for prospective buyers and information of delivery services

providers [22]. Until today, in Indonesia, there is no system that can integrate the information of the parties in the supply chain in agriculture, especially a dedicated system to be used by many people and parties. On the other hand, there is a need of an Intelligent Systems in the field of logistics – a customer oriented system – to overcome the existing challenges [14], [16].

A web-based system allows all parties to be interconnected. The simplest example is e-commerce. Through this system, seller and buyer can be interconnected, thereby removing the distance between retail distributors and end users. The same concept can be applied in the field of agricultural commodities. A farmer can sell at any party anywhere. However, compared to non-agricultural goods, agricultural goods have a very different characteristics, because the agricultural products experienced a permanent modification, from the moment the product is harvested until the processing phase [2], [17]. Some agricultural products lifespan is short, some products must be packaged in special packaging [3], [14], the weight of agricultural products is quite large, and the production sites are in a very diverse place. For example, agricultural products which is produced in Java Island can be delivered to Sumatra Island through various parties, the manufacturer - retailer - consumer. The goods can be delivered by a variety of transportation modes. The fastest travel time is by airplane, another alternative is using trucks with a longer travel time and other alternative is using sea transportation modes [10]. In Sulawesi Island there is a solution to distribute agricultural products by using a motorcycle. The last transportation mode is using a combination of transportation modes/intermodal, although there were challenges when it is applied [6]. The difficulty in determining transportation modes and delivery services provider bring opportunities for both organizations and individuals to get involved in the supply chain. Thus, there are at least three parties in the supply chain that can be included in the study, sellers, distributors and buyers.

Research conducted by [1] aims to facilitate the distribution of information generated by farmers where the system can be accessed by anyone via the Internet. In that study, the system can provide information of commodities prices, products, product sales offer and bids for products, but not address the problem of distribution. The concept used in the study is known as crowdsourcing. An emerging concept in the field of business in 2005 explains the concept of the process of achieving a goal of both goods and services through online media from the contributions of many parties.

Research conducted by [4] focuses on making supply chain systems which cover manufacturing to shipping route. However, the study was built only to be used by one particular organization, not to accommodate the interests of many people or other organizations. From the description in the introductory part, it can be concluded that agricultural sector in Indonesia need a system that can be used by many parties that will ultimately benefit many parties. As an analogy and description of the system that is needed, the system is a combination of systems: 1. e-commerce; 2. Services of transport / distribution which allows many parties to be involved, which is currently is a trend like Uber, Grab Bike, etc. [21]. In other words, we need an Intelligent System that can provide information needed by seller, distributor and buyer which is integrated into a system that support crowdsourcing. This paper will discuss the potential solutions, both from the standpoint of the seller, buyer and distributor and also will be described a web-based system that has been developed using the programming language PHP and database MySQL that can be a place for sellers, buyers and distributors to have a transaction and has the capability to provide recommendations of the most suitable distributor to deliver the product in accordance with its characteristics.

## **2. LITERATURE REVIEW**

This section will explain some of the literature studies that have been done that is used as a basis to make the supply chain system of agricultural products in Indonesia, which in this case focusing on the solution of transportation / distribution. This section is divided into 4 parts: supply chain scheme, current conditions of transportation in Indonesia, collaborative transportation and evaluation criteria of transportation performance.

### **2.1 Supply Chain Scheme**

The literature study is done to determine the condition of ideal scheme supply chain that exists today, where it can be used as a reference of supply chain scheme in Indonesia. In [17] mentioned about approaches to introduce the concept of 4PL. A 4PL is a neutral provider of various services within the supply chain. This provider does not supply assets but endeavors to utilize all provided resources efficiently and sustainably while integrating all involved actors [13], [19], and [23]. One objective of the 4PL is to minimize individual inefficiencies and, at the same time, increase the efficiency of the entire actor network. The main task is to plan both the supply chain process and transportation. This planning is accomplished by employing IT networking and platforms (Mammitzsch and Francyk, 2012). Therefore, industry-specific agencies must be taken into account, and corresponding knowledge is required [8].

Similar form offered by [9] which is described in the paper was that there is a need for a parties to integrate the actors involved in the supply chain system, the parties are called "consolidator". Consolidators are agents, export companies, consortium or brokers that provides a complex set of services to agro-food SMEs. These services are carried out by receiving orders from big foreign buyers, identifying local suppliers, consolidation, collections of many goods to be sent to the same market and placing of products on the market. The consolidator must, therefore, know all issues related to both the origination and destination markets, have the trust of foreign buyers in order to ensure stable relations and have many contacts with local SMEs to ask for supplies of goods.

Based on the two of these studies it can be concluded that a system that allows for parties to organize the existing supply chain is needed. A web-based system which integrates Sellers, Buyers and Distributors can accommodate those needs. For more about the features needed by distributors can be found in the next sections.

## **2.2 An Overview on the Challenges of Transportation in Indonesia**

Indonesia is an archipelagic country, but unlike Japan, there are very few bridges or tunnels between the islands of the Indonesia [7]. Ferry services growth has already reached many areas. However, the reputation of these shipping companies is severely tarnished, as in Indonesia and Bangladesh by the frequency and severity of accidents in recent 25 years. It has become essential to improve the logistics of food transportation across the archipelago to ensure quality supplies to the capital region, and provide outlets for the farm productions of the country's poorer regions, all while fostering the growth of agro-industrial activities.

Another problems are lack integration transport modes, both intra and inter-modal in areas that have modes of land transport, distance of the small islands in the archipelago province varies, sea and air transport accessibility is exist but the frequency of services to small island very limited.

In spite of the problems that exist, ITS (Intelligent Transportation Systems) Indonesia developments is emerging by [18], although unfortunately it is still not synchronized and coordinated. Information heterogeneity of ITS Indonesia becomes an obstacle to provide interoperability. They also suggest establishing Cloud ITS based on cloud computing, it is feasible to accommodate transportation information sharing platform.

It can be concluded that Indonesia has challenges in terms of the infrastructure that supports the transportation and distribution of goods. But it is believed that a system that can distribute information about the parties in the supply chain can help optimize existing infrastructure today.

## **2.3 Collaborative**

Fernández in [12] states that collaborative transportation is regarded as one of the major trends in transportation research. Indeed, increasing carrier insurance and fuel costs combined with a more intense market competition lead carriers to look for new and more efficient solutions. Based on interviews that have been conducted, a buyer can change their supplier if the price change significantly. Switching to other suppliers can occur even if the location of another supplier is hundreds of kilometers apart. On the other hand, the seller can sell and deliver their products to distant locations with more expensive modes of transportation such as by plane if the selling price is

high. This high level of flexibility requires a system that can integrate seller, buyer and distributor that enables collaboration among them, especially the distributors, which in turn it can increase the effectiveness and efficiency of product distribution.

## 2.4 Evaluation Criteria of Transportation Performance

Literature study in this section is conducted in regard for knowing what factors or criteria that can be used to assess the distributor – transportation service provider. Baran & Zak in [5] specify the criteria that can be used. Among them, which will be used in this research are:

- Transportation costs, which is composed of two sub criteria, fleet utilization cost and ton kilo metre costs.
- Delivery time. This minimized criterion is defined as an average time of delivering orders to strategic customers located within 100 km radius from the company's headquarter (depot). This criterion depends on the distance of a given enterprise from its key customers and the average technical speed of the vehicles available in the fleet.
- Fleet modernity. This criterion is defined as an arithmetic average of the age of all vehicles used in the company.
- Transportation reliability, which is composed of two sub criteria, timeliness of deliveries and Fulfillment of deliveries.
- Transportation Quality, which is composed of two sub criteria, failure-free transportation (deliveries) and Share of deliveries of unspoiled goods.

## 3. RESULT AND DISCUSSION

### 3.1 SCM in Indonesia-The Concept of an Ideal Condition

This section will explain the proposed plan of the ideal supply chain system concept implementation that can be developed. In general, a system that can accommodate the supply chain in Indonesia can be seen in Figure-1. It can be seen that the three entities embodied to the supply chain system which in this case is a web-based system. The system is expected to "simplify" the entities involved. For example, Seller are the parties who offer products e.g. Farmers and Wholesaler. Buyer is the parties who need the product, for example, the end user. Keep in mind that a party may be the Seller and Buyer, in different phases. Wholesaler for example, can become a seller when selling their products to the end user, or they can act as buyer, when purchasing products from Farmers.

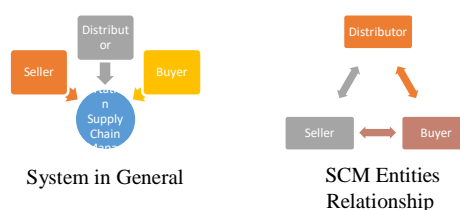


Fig 1. Supply Chain in Indonesia

The existence of the system is expected to streamline the communication between entities. In general, the relationship between Seller and Buyer in the proposed system is the same as the relationships that occur in the online shop system. However, with the involvement of distributors, the process for selecting the most suitable Distributor, in accordance with the desired characteristics becomes easier. Figure 2 shows that the Seller, Buyer and Distributor can communicate with each other. This is necessary because there are customary in Indonesia that the buyer is a party to bear the costs of distribution.

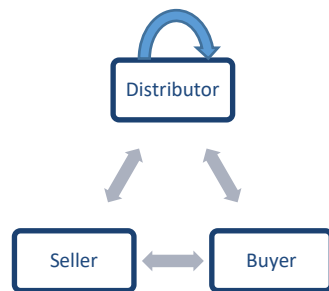


Fig 2. Collaborative - Intermodal

Other forms of relationships that can be developed is a management system that enables collaboration among distributors. This approach is urgently needed in Indonesia given the geographical situation which is archipelago. With the existence of this collaboration, the implementation of supply chain involves Intermodal is expected to occur, so that efficiency can be achieved. Example: A product is delivered with from City A to City B through distributors who use Truck mode, then shipping the product from City B City C through distributors who use an airplane to transport the product. See Fig. 3. At the end of the development, it is hoped that the system can accommodate the entity that serves to integrate all entities involved in the supply chain.



Fig 3. Collaborative - Intermodal

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