CPO DELIVERY CONTROL IN THE PALM OIL AGRO-INDUSTRY: A LITERATURE REVIEW

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Abstract

The CPO supply chain currently faces several problems: CPO logistics costs in Indonesia are high compared to other countries. This is due to inadequate infrastructure, supply chain inefficiencies, and lack of technology utilization. The CPO supply chain is vulnerable to various risks, such as price fluctuations, weather, and natural disasters. This can lead to disruptions in deliveries and financial losses. Demand for CPO may fluctuate depending on global economic conditions and government policies. This can make it difficult for companies to plan their distribution needs. Supply chain management in agroindustry emphasizes a management approach to a network of facilities and distribution channels, including procurement of materials, production, and delivery of agroindustry products to end consumers. The research methodology used is the Systematic Literature Review (SLR) method, which is the literature review method that identifies, evaluates, and interprets all findings on a research topic to answer research questions. This article develops an integrated model for controlling the transportation of CPO from the mill to the customer, the mill processing CPO into derivatives, thus demonstrating a sustainable supply chain relationship. This research will explore how SCM, 3PL, and risk management can help overcome problems in the CPO supply chain.

Keywords: *SCM, 3PL, Risk Management, CPO*

INTRODUCTION

Industry players are realizing they can provide cheap, quality, and fast products in company operations. These three aspects require collaboration, coordination, and synergy of work from all parties, starting from suppliers who process raw materials into components, factories that convert components from raw materials into finished products, transportation companies that deliver raw materials from suppliers to factories, and distribution networks that will deliver products to customers. The important challenge of balancing palm oil agro-industry productivity and environmental sustainability becomes a key factor for all stakeholders in the integration model, and the gaps in the process are discussed.

Keeping in mind the mutually influencing inventory policy and transportation policy, the model in this study aims to set the production policy at the factory, the ordering policy at the buffer stockpile tanks, all distributors, as well as the transportation policy to move the products from the stockpile tanks to the distributors so that the total system cost over a planning horizon is minimum. The total system cost includes order, storage, outsourcing, and transportation costs at all echelons.

Most of the inventory policy research in proven supply chain systems has been described as a tool and a technique to analyze the success of SCM strategies in the palm oil agroindustry that have not yet been integrated with transportation policy. In the sustainability model (S. H. Gheewala et.al, 2022), we have developed inventory policy models integrated with transportation policy (S. Nupueng et.al, 2022).

Using this approach, the total demand at the distributor can be calculated from the total demand at all the retailers it supplies. This also applies to the buffer stockpiles and mills that process CPO into derivative products. All entities in the supply chain system must adhere to this coordinated inventory and transportation policy (Chen et.al, 2023).

In an agricultural supply chain, companies can be broadly substituted by activities that produce fresh or processed products from farms, using appropriate technologies that add value to the final products. The supply chain of fresh agricultural products, such as vegetables, flowers, and fruits, will, therefore, typically involve farmers, auctioneers, wholesalers, importers and exporters, retailers and specialty stores, and third-party logistic providers (Arif, M et.al, 2023).

Palm oil is an agricultural product processed using a series of activities, from the harvest of palm fruit bunches to palm oil production along the chain of storage and distribution. This may include handling, conditioned storing, packing, transportation, and special trade goods. As with other perishable products, the main issue faced by the stakeholders in the palm oil supply chain is to ensure the product is fresh when reaching the hands of consumers (Jeong, M et.al, 2022). Palm oil, like other processed products such as canned meats, snacks, juices, desserts, and cooking oil, has a high economic value, and as such, it is usually processed using state-of-the-art technology to prolong its shelf life.

Agroindustry supply chains are also quite distinctive due to the time and climate-sensitive characteristics of agricultural materials. Therefore, inventory management, transportation, and other supply chain components must be designed with these characteristics in mind. The discussion of agroindustry supply chains has not been widely carried out because looking at the condition of agricultural commodities is easily rotten and quickly damaged so that to conduct a study of transportation control requires a very deep understanding, and supply chain studies are generally carried out by researchers with a background in management or engineering science (Othman, N et.al, 2022).

Quantifying the supply chain risk faced by different firms would be important but challenging because supply chain risk comes from many sources and multiple channels. For instance, firms may be indirectly exposed if their suppliers, or the suppliers of their suppliers, face bottlenecks. Similarly, firms may be exposed through their customers if downstream firms cannot source complementary inputs and are forced to limit production. Furthermore, commercial data sources mainly focus on big customers and suppliers, providing limited coverage of the potential source of shocks over the supply network. While these data sources are useful for quantifying the effects of shock propagation, they do not allow us to gauge how firms perceive supply chain risk and adapt their strategies to mitigate supply assurance concerns (Primadasa & Christata, 2023).

Our objective in this paper is to develop a proxy for supply chain risk using textual analysis and to study which firms are most affected by supply chain risk and the extent to which supply chain risk affects firms' policies and industrial structure. We perform a textual analysis of earnings conference calls to measure supply chain risk. Following (Primadasa & Tauhida, 2020), we measure supply chain risk by discussing supply chain issues related to words capturing risk and uncertainty. We also use topic modeling analysis to ascertain the sources of supply chain risk and construct a measure of the sentiment of supply chain discussions to capture negative realizations of supply chain shocks. Supply chain sentiment can also help us capture news about the conditional mean of supply chain shocks for a similar interpretation of political sentiment (0 S. Siallagan and A. Ishak, 2023).

With the growing complexity and efficiency of the supply chain, 3PL firms have integrated a variety of services, including both conventional and refrigerated transportation (

Ö. F. Gürcan et.al, 2016), smart warehousing, and dedicated contract carriers (A. De and S. P. Singh, 2022). Thus, a wide variety of diversification in strategic and service portfolios keeps the 3PL focused on enhancing service quality (Nabilah and R. Vikaliana, 2022). However, fresh agri product transportation requires more attention in the technological domain, as inadequate refrigeration and automation during long-duration transportation results in the growth of bacterial and fungal infections. Different technology research and development cells are working on enhancing the cold chain service level. Some of the giant 3PL firms outsource technology innovation. However, it is not mathematically clear under which circumstances a technology outsourcing scheme can be profitable for 3PL firms (Arjuna, A et.al, 2022).

RESEARCH METHODS

The research method used in this paper is to use a systematic literature review method approach, often abbreviated as SLR. This method examines, summarizes, and interprets all problem findings on a research topic and answers research questions that have been previously determined. The SLR method is carried out systematically by following the initial stages in the research disbursement process related to the research issue with the literature review method to avoid biased and subjective understanding of the researcher. The systematic literature review method is a systematic system approach to the scope of research methodology, gap research, conceptual, and log frame. In contrast, the traditional review method does not use research methods based on the author's inclination.

In the qualitative approach, the systematic literature review is used to synthesize the findings of several secondary data studies. Summarizing the results of several qualitative studies is called meta-synthesis. Meta-synthesis is a technique of bringing together data perceptions to find new theories to increase a more radical and comprehensive understanding.

Increasing the competitiveness of palm oil supply chain management requires a comprehensive approach. We argue that risk management, performance evaluation, and production planning are the three important elements required to manage this supply chain effectively. However, frameworks that integrate risk, performance, and production measures holistically in the context of supply chain management of sustainable palm oil appear to be lacking (Domingues, 2015).

Palm oil is an agricultural commodity that has an important role in the Indonesian economy. The increasing demand for processed palm oil at home and abroad causes the company to be overcapacity, so it requires the services of a third-party company to assist its operational activities. One of the services often used is a third-party logistics company, often called Third Party Logistics (3PL), in the form of a tank truck rental company, which will hereafter be referred to as a truck rental company (Foong and D. K. S. Ng, 2021).

The scheduling of truck rental allocation by truck rental companies must be well planned and made so that the trucks owned can be used optimally so that rejection of orders due to increased demand for truck rental by palm oil processing companies can be avoided or minimized. The non-dynamic allocation of trucks also causes delays that affect the total costs incurred due to having to pay penalty fees. Research needs to be done to create dynamic scheduling that can solve a combination of VRP problems (Lim, H et.al, 2021).

To facilitate the resolution of the above cases, it is necessary to create a mathematical model of the combination of VRP problems that exist in real conditions. This study aims to obtain a mathematical model of the combination of these problems to minimize the company's total operational costs and penalties later.

Research will be conducted to obtain a mathematical model of the scheduling problem in the form of truck rental vehicle allocation in a 3PL company engaged in the delivery of processed palm oil. The mathematical model is made by considering VRP problems that often occur in the operational activities of truck rental companies, such as CVRP, VRPPD, VRPTW, SVRP, and PVRP problems (Nugraha, A.D et.al, 2022) .

This research begins by identifying problems in the form of a combination of VRP problems in third-party logistics companies. This aims to minimize operational costs because there are three financing systems: costs based on mileage, the number of rotations carried out, and the cost of a combination of the two financing systems. Minimize penalties, which will be charged to third-party companies in the event of delays. Balancing the route in terms of travel time and the transport load of CPO tank truck vehicles. After the data is collected, a mathematical model of the existing problem is made using Integer Linear Programming (ILP) (A. Osorio-Mora et.al, 2021; A. Putra et.al, 2020).

The research was conducted at a company in the business field of renting tank truck vehicles whose customers are palm oil processing industry companies. In this case, the fleet is a tank truck carrying liquid cargo. The third-party company that uses the vehicle serves one customer for each vehicle. Thus, in the case of non-compartmental truck rental, the load distribution system uses a rotation system. A rotation is a distribution activity in which there is one loading and one unloading, commonly referred to as one transaction round. If the demand exceeds the maximum transport capacity, then more than 1 (one) rotation will be carried out. Large quantities of requests to factories usually require a large number of transportation fleets and many rounds in order not to experience delivery delays.

In this paper, the three main pillars, based on the concept of key success factors for managing the sustainable palm oil supply chain, are proposed. These are:

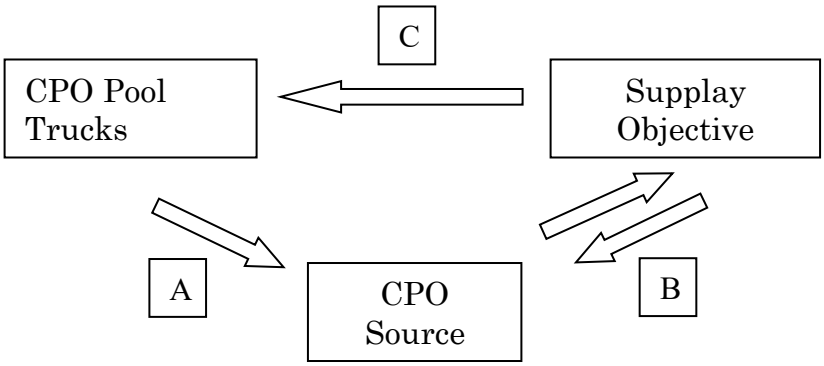

Figure 1. CPO Load Transportation Process

Based on Figure 1. it can be seen that there are 3 (three) basic routes in carrying out load transfer activities, namely:

A. Travel from pool to source. This route is the initial stage of the load transfer activity. The tank truck that has been allocated travels to the source point of loading, in this case, the renting company. In this route, the cost is based on the consumption needs of diesel fuel, which is converted into Rupiah.
B. Journey from source to destination. This journey begins with loading cargo into the tank truck. After the tank is full, the truck will walk to the destination point to carry out unloading activities. Rotation is done more than 1 (one) time when there is still cargo to be moved from the source point. If there is only one vehicle allocated and the cargo has

not been completely transported, the truck must return to the source point to carry out the second delivery activity (Second Rotation and so on until the cargo at the source point runs out) instead of returning to the pool.

C. Travel from the destination back to the pool. If the load at the source point is exhausted, the truck that finishes loading and unloading at the destination point will return to the pool (not return to the source point). On this route, the costs incurred are the same as the first trip, which is based on the need for diesel fuel consumption.

When the smart solution has been reasoned and chosen, its deployment within a supply chain must focus on its elements or nodes. We have allocated particular tank truck (and their groups) with the application in a supply chain node and engaged actors. A strategic approach essentially incorporates an evaluation of performance and results relative to the set goals and objectives. This assessment is important not simply to evaluate the effectiveness of a strategy itself but also to measure the progress and responses to changing conditions (Putri et.al, 2021; Riccardo et.al, 2021).

We also investigate the actions firms take to manage supply chain risk. First, firms appear to actively manage supply chain risk by increasing the number of their suppliers. In addition, firms that communicate more uncertainty about their supply chain subsequently establish relationships with suppliers that can be considered industry leaders and with nearby suppliers, suggesting that these firms attempt to increase the reliability of their supplier network (Rosyidi et.al, 2022). However, we find no evidence that firms sever their relationships with suppliers in other continents, suggesting that supply chain diversification and nearshoring do not necessarily imply more fragmentation.

RESULTS AND DISCUSSION

The challenges faced by the palm oil industry in Indonesia lie in supply chain risk management, specifically in the integration of decision-making at the operational level. Problems at this level have become more apparent. At the same time, the industry continues to face pressures as a consequence of the strict conditions imposed by, predominantly, international trading communities, and in some cases, by environmental issues from domestic and overseas (Tufano A et.al, 2019). As part of an effort to address the underlying problems, this paper aims to propose a conceptual framework that can be used to effectively manage

the palm oil supply chain by integrating risk assessment, performance measurement, and supply chain optimization.

The next stage in supply chain management is integration. SCM requires integrating all activities such as sourcing, procurement, production scheduling, order processing, inventory management, transportation, manufacturing, warehousing, and customer service. This integration process shows that the integration of multiple functions in the agro-industrial supply chain system at different organizational levels can deliver above-average financial and performance results. However, finding that enterprise integration is associated with all enterprise integration initiatives is equally important. It proves that enterprise initiatives are different from its goals and proposes a framework for establishing enterprise integration initiatives based on organizational capabilities. Presented an integrated business process model, highlighting the importance of communication between processes and partners in the supply chain. It is concluded that although there is widespread acceptance of the strategic importance of integrating operations with suppliers and customers in the supply chain, there are still fundamental weaknesses in the operational aspects of supply chain strategy.

As the global market becomes more sophisticated, the difference between the operations a company wants to achieve and what a company manages to perform in-house is increasing. The tendency among firms from all sectors is to outsource their logistics activities that are more costly and time-consuming to external entities, namely logistics and third-party logistics providers (Utama et.al, 2022). 3PL firms provide a variety of logistics-related services, including, for instance, transportation, warehousing, distribution, and freight consolidation. Outsourcing these activities enables companies to reduce costs and focus on their core activities, which allows them to build a competitive advantage over adversaries (Arif M, et.al, 2023).

The author explores the relationship between supplier and customer integration and discovers how these strategies differ and affect company performance.

The Penalty value will be charged to the 3PL as compensation for the delay in the client company's load transfer project. The amount of penalty per hour of delay is usually 0.25% of the revenue received by the 3PL for the job i., so it can be formulated as follows:

$$Rti = ri \cdot Qi \quad (1)$$

$$Pi = 0.25\% \cdot Rti \quad (2)$$

Parameter:

Rti =Total revenue from a job I load movement

ri = Transportation revenue per kg of load moved by project I.

Qi = Quantity of cargo to be delivered from point i to point i+n

Pi = Penalty fee per hour for the delay in a project I.

A challenge for any measure of risk and uncertainty is that news about the variance of shocks may be correlated with negative shocks or shocks to their conditional mean Dahliani L, et.al, 2022). Overall, supply chain risk may arise from a variety of sources that are hard to quantify using financial data: Not only do firms have customers and suppliers that are typically hard to observe, but even if we observed all the shocks affecting a firm's production network, we would be unable to quantify a firm's exposure because suppliers may choose to prioritize different customers and markets (Dalal J, 2021).

The literature review analyzed in this study is based on 27 references. To distinguish the elements of differentiation between the author's work, in terms of logistics coverage, scope, and specific characteristics, a classification was performed.

The framework used to classify the literature follows the logistics three dimensions approach, redesigned and adapted to illustrate each of the analyzed frameworks' purpose and scope. Therefore, two generic classifications were added to distinguish the scope of the analyzed work: risk management and 3PL.

Companies determined to use 3PL services expect more efficient and less cost-demanding processes rather than performing these processes in their establishments. 3PL companies perform a wide range of operations. They take care of the delivery of goods, storage, revenue, assembly, loading, labeling, repacking, and distribution. Additionally, the data must be collected and transmitted to the client. Their work is to optimize the logistics processes, where operating costs depend on several dozen components. 3PL is a growing area; however, companies do not pay enough attention to 3PL improvement, which would be seen not only as a real benefit for the company but also would help to identify 3PL directions to improve. Therefore, companies need to evaluate 3PL service criteria and select the best

ones. Unsuitable 3PL services may lead to customer dissatisfaction and a reduction of long-term cooperation.

In our study, using the Power BI package programs, relationship analyses regarding the common citation links of the articles, the links between the countries where the articles were published, the links between the journals in which the articles were published, the links between the words searched in search engines and the links between the authors who published joint articles. made and visualized. The analyses of our study were made using the classification and bibliometric factors used in similar bibliometric studies with these techniques in the literature. In this sense, since many factors used in the literature were used in our study, there was no need to add a new factor or an additional classification.

It will help decision-makers to look at the current and past studies on SCM in the coming days. In this respect, it is considered that this study will provide an important perspective and support to SC decision-makers, managers, sector employees, and related parties. In other words, it is thought that it will guide academic research in the field of SCM and transportation in the future and provide an opportunity for comparison. In the following studies, the development levels, economic situations, per capita national income, population, geographical, political cultural situations and education levels of the countries that give importance to SCM can be examined in detail and a comparison can be made. Frequency and relationship analysis can be made for the university or the institutions in the sector where the authors work in the field of SCM work. In addition, a more comprehensive bibliometric analysis can be made by considering a wider time frame and specifically examining other types of work other than the article. Finally, studies can be enriched by using the PowerBI for bibliometric analysis.

The following are the results of article data grouped by year of publication based on the keywords selected in this article, as shown in Figure 2.

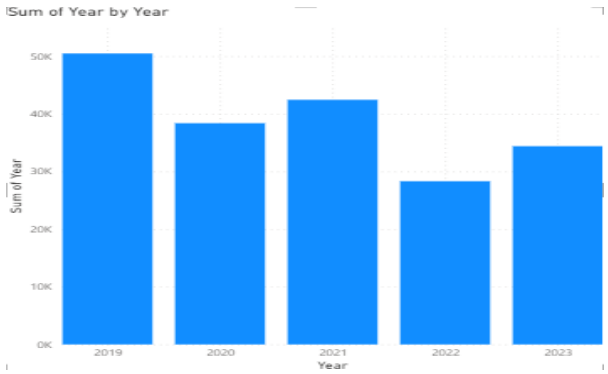

Figure 2. Distribution of studies by years.

In addition to the frequencies given in Figure 2, visualization was made using the Power BI program to add depth to the keywords searched in the search engine, to attract more attention of the reader, and most importantly to explain the relationships between the keywords. The word cloud image obtained after the analysis is presented in Fig. 3.

Fig. 3. Relationship cloud image of keywords.

Agroindustry supply chains rely on synergies between supply chain actors and business interactions related to products, services, financial resources, and information. Agroindustry supply chains aim to synergize the relationships between supply chain actors in the agroindustry sector, creating organized ways to manage activities. Supply chains' ability to interact with each other depends on the consensus of the actors involved in building relationships within the system. Some of these research journals define managerial concepts, business conditions, and supply chain development on CPO transportation control in

agroindustry, so there is a need for intensive research to be carried out in several countries in the world in this field, especially in the field of oil palm agroindustry.

Agroindustry supply chains involve costs to convey information, producing component aspects, processing and storage, transportation in management, and transferring funds in transactions. Total agroindustry supply chain costs tends to increase due to many parameters such as large capital costs required to run a global business business, rising raw material costs, and transportation costs. However, perfect planning in the agro-industry supply chain regarding material arrival, production, and distribution schedules not only reduces raw material inventory but also reduces time and energy wasted. Research literature in other supply chain fields has shown that there is a relationship between inventory investment and business cycle fluctuations in the supply chain management drastically changed the inventory investment investment in various industries, and helps cope with economic fluctuations.

Producers are spread graphically across all supply chain actors in agro-industry supply chains.

Graphically across the supply chain actors. Each company in the agroindustry sector are involved in various supply chain activities such as order fulfillment orders, procurement of raw materials, utilization of information technology, and transportation so as to have faster and more reliable delivery of products and customer service. SCM covers more extensive marketing areas when carrying out distribution activities. The entire supply network can improve its ability to meet consumer expectations consumers expectations in terms of quality through quality management and supply chain practices. By using the principles of supply chain management management principles in agroindustry, the company will be able to reduce product defective products and improve relationships in the supply chain. In the concept of agricultural products, today's agricultural products are controlled by the problem of uncertainty. SCM characteristics that ensure higher product availability to avoid lost sales/stock outages. It also emphasizes the importance of efficient consumer response to achieve customer satisfaction and business efficiency.

Agroindustry supply chain management is related to the process of procuring raw materials and the production process that relates to the raw material suppliers. Control and control of control and control of good raw materials will make the production system

effective and efficient. Accuracy decision making is very important in the performance of the agroindustry supply chain, therefore the human resources owned by the perpetrators must have the potential to understand agroindustry supply chain management so that the company does not experience losses due to errors that occur when ordering raw materials.

The fundamental difference in characteristics between manufacturing products and agro-industry products also leads to differences in the supply chain between the two. Stated that what makes agro-industrial supply chains different from other product supply chains are other products are: (1) the nature of production, which partly based on biological processes, thus increasing diversity and risk. (2) the nature of products, which have some special characteristics, such as perishability and the need for space to store them, thus requires a certain type of supply chain. (3) social and consumer behavior towards food safety issues, animal safety, and environmental pressures.

For almost all supply chains, value is highly correlated with chain profitability and supply chain profit. Supply chain profit is the difference between the revenue earned from consumers and the overall supply chain costs, where in a supply chain there is one supply chain there is one source of income, namely consumers. Supply chain profit is the total profit that is divided across all stages of the supply chain. The higher the profit of a supply chain, the more successful the supply chain is. Success in a supply chain should be measured in terms of the profitability of the supply chain as a whole and not the profit of each actor. All information, products, and money flow is costly to the supply chain. Therefore, good organization of these flows is key to the success of the supply chain.

CONCLUSION

Agro-industry supply chains aim to synergize the relationships between supply chain actors in the agroindustry sector, creating organized ways to manage activities. The mathematical model can be used as a reference or initial guideline in allocating vehicles for third-party logistics companies (3PL), especially those engaged in transporting processed palm oil. This research encounters many difficulties, one of which is applying transportation problems in the real world to the research conducted. Many obstacles in real conditions have not been taken into consideration in making mathematical models; it is hoped that in the future, research can be carried out on vehicle allocation for 3PL companies by considering

problems such as taking into account the maximum number of queues at both the source and destination points and even taking into account congestion factors that may occur during delivery activities. Optimal truck allocation scheduling will be obtained from solving the mathematical model by entering the required parameters such as several orders, delivery distance from the source point to the destination point, revenue/kg, piece or rotation costs, loading time, cleaning time, source and destination point time windows, as well as the number and capacity of vehicles.

It is necessary to conduct further research on the synergy of the supply chain in the palm oil agro-industry in the form of an integration model on improving the ability to control transportation starting from transportation resources and the organization of 3PL actors so that it is more optimal, effective, and efficient.

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