

The assessment of fresh fruit bunches supply chain of palm oil independent smallholder farmers in southeast Sulawesi

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ABSTRACT

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Palm oil commodity in Indonesia is the cash crop for smallholder farmers especially in the dry land area. This smallholder has contributed to produce Crude Palm Oil (CPO) about more than 40 percent in the supply chain. This study is aimed to identify downstream and upstream in the line of CPO palm oil. Secondly, is to know the role of the actors in the CPO supply chain and its traceability. This study employed the traceability method of networking of CPO supply chain in Southeast Sulawesi, Indonesia. Two research sites were conducted as the implementation of survey, observation, interviews and Focus Group Discussion (FGD). The respondents have chosen from the downstream to upstream of the CPO supply chain. Independent farmers, middlemen, delivery order, and Fruit Fresh Bunches (FFB) mills to produce CPO have been interviewed as the key informant of this research. Traceability study shows that the main source of FFB came from the core of PT. Damai Jaya Lestari both in the research site, plasma, and independent farmer. In North Konawe, the downstream line that farmers sell the FFB to the middlemen then they bring to the agency who has the delivery order from the CPO mills. Meanwhile, in Kolaka District, Independent farmers sold the FFB to the agency who has the contract with the PT. Damai Jaya Lestari in Plasma Village, Poligona Sub District. In terms of the green economy, waste such empty bunches were limited access for farmers who wanted to proceed with the waste for organic fertilizer and feeding cows. The role and the traceability study show that independent farmers have no access to utilize the waste of empty bunches, no protection from the Damai Jaya Lestari as the CPO mills, and have no institutional farmers as the farmers group.

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1. Introduction

Palm oil is one of the essential commodities in Indonesia, as this country is world's most significant crude palm oil (CPO) producer and exporter, contributing to more than 55% of global production and export (FAO, 2022; ITC, 2022; Shigetomi, Ishimura, & Yamamoto, 2020). In terms of export, palm oil is the highest contributor to Indonesia's export, with a share of about 12.35% of total export values (BPS, 2022). Indonesia produced 45.7 million tons of CPO from a total area of 14.58 hectares, spreading over 25 out of 34 provinces in the country (BPS, 2021; Ditjenbun, 2021). Although the palm oil area is still dominated by private and government enterprises (about 58.5%), the contribution of smallholder farmers is relatively high, cultivating an area of 6.04 million hectares. About 2.56 million farm households are involved in palm oil plantations. In addition, palm oil enterprises have a labor force of 4.42 million (Ditjenbun, 2021; Hong et al., 2012). Although it has several externalities, the expansion of palm oil plantations also benefits small-scale farmers in rural areas as it alleviates poverty,

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increases rural households' income and welfare, and improves the local infrastructure and economy (Krishna & Kubitza, 2021; Mehraban et al., 2021; Qaim et al., 2020; Santika et al., 2020).

Indonesia's export performance in September 2022 recorded a positive growth of 20.28%, with three leading export commodities—steel, palm oil, and coal. Indonesia has the potential to contribute 52% of palm oil to the world market and produce 40% of the world's total vegetable oil (Palm Oil Statistic, 2021). This condition is like an oasis that revives the spirit of national economic recovery in fluctuating global economic conditions. Indonesia's palm oil industry plays a vital role in its economy with the increasing performance of the palm oil trade, and this industry also involves many business actors from various economic groups. In this regard, national oil palm plantations continue to grow significantly, with an area of 16.38 million hectares and absorbing a workforce of more than 17 million heads of families, farmers, and employees, who work in both on- and off-farm sectors (Palm Oil Statistic, 2020). The development of the downstream industry is also a strategic effort to increase the added value of the palm oil industry so that it does not only concentrate on raw materials but also expands to the downstream industry, even to the final product. With this effort, the added value will undoubtedly remain in the country.

Regarding the regional economic aspects, this industry is quite strategic in developing regions into new growth centers, especially in palm oil centers such as Sumatra, Kalimantan, and Sulawesi. Moreover, to encourage growth and equitable distribution of economic opportunities in oil palm plantations, the government encourages the partnership model as a form of synergy between farmers and companies. This partnership pattern will attract investment in other sectors, such as industry and consumption. The strengthening of oil palm plantations and industry needs to be supported by research and development programs for oil palm plantations from upstream to downstream to increase knowledge about cultivation, product processing, industry, markets, and the value of plantation products, as well as the potential for business development. In addition, to encourage the sustainability of the palm oil industry, the government has implemented a regulatory framework and encouraged multistakeholder cooperation in the palm oil sector through regulations, such as The Presidential Regulation No. 44 of 2020 on Indonesia Sustainable Palm Oil Certification; the Presidential Instruction No. 6 of 2019 on the National Action Plan for Sustainable Palm Oil 2019-2024; and the National Strategug Program on People's Palm Oil Replanting stipulated in Minister of Agriculture Regulation No. 3 of 2022 on Human Resources Development, Research and Development, Replanting, and Oil Palm Plantation Facilities and Infrastructure (BPS, 2022).

In 2018, the area of oil palm plantations based on land use and CPO production increased significantly. The increase was due to the rise in the administrative coverage of oil palm companies. In 2019, there was an increase in the area of oil palm plantations and CPO production to 14.46 million hectares, with a production of 47.12 million tons. Furthermore, in 2020, there was an almost stagnant increase of 0.90% to 14.59 million hectares. Oil palm plantation areas are spread across 26 provinces in Sumatra and Kalimantan, West Java, Banten, Central Sulawesi, South Sulawesi, Southeast Sulawesi, West Sulawesi, Gorontalo, Maluku, North Maluku, Papua, and West Papua. According to the status of exploitation in 2020, the area of oil palm plantations did not experience significant changes. As in the previous year, the control of the oil palm plantation area is still dominated by large private plantations. A total of 7.98 million hectares (54.69%) of oil palm plantations are controlled by private plantations, followed by smallholder plantations that hold 6.04 million hectares (41.44%), and large state plantations own the remaining 0.57 million hectares (3.87%). Based on the status of the companies, in 2019, 63.79% of palm oil (CPO) production (30.06 million tons) came from large private plantations, 31.68% (14.93 million tons) from smallholder plantations, and the remaining 4.53% (2.13 million tons) from large state plantations. According to the HS Group of Palm Oil, in 2020, the largest export was "other palm oil" (HS 15119000), amounting to 67.90% of Indonesia's total palm oil exports (Palm Oil Statistic, 2021). Furthermore, the most considerable palm oil export contributions were CPO (HS 15111000), "other palm oil kernel" (HS 15132900), and "crude oil of palm kernel" (HS 15132110), with contributions of 25.95%, 5.05%, and 1.10% to total exports, respectively. Indonesia's palm oil production is mainly exported to foreign countries, and the rest is marketed domestically. Indonesia's palm oil exports have reached five continents—Asia, Africa, Australia, America, and Europe—with the highest proportion going to Asia. In 2020, Indonesia's top five CPO-importing countries were India, Spain, Malaysia, Italy, and Kenya. The total CPO exports to these five countries accounted for 86.68% of Indonesia's total CPO exports. The largest CPO export destination is India, with an export volume of 4.39 million tons or 61.23% of Indonesia's total CPO export volume, with a value of US\$ 2.87 billion. Spain and Malaysia are the second and third, with export contributions of 10.73% and 5.22% of total CPO exports, respectively (Palm Oil Statistics, 2021).

Smallholder plantations account for approximately 40% of the total area of oil palm plantations in Indonesia. Little is known about the legal status of independent smallholder oil palm production. The number of farmers who do not have and those who have problems with their land and how to differentiate between them in the supply chain are unknown. The same is true for large companies. Aside from companies that have obtained sustainability certification, there is no mechanism to ensure that all palm oil products produced and circulated in Indonesia have clear production legality. Compared with large companies that generally have internal procedures and are familiar with implementing systems and are compliant with licenses, implementing supply chain traceability systems and legality verification will be very complex for informal actors. For oil palm commodities, there have been several studies on independent oil palm smallholders that mention or discuss the role of these intermediary actors. For example, Watts et al. (2021) discussed the profile of independent smallholders in Central Kalimantan, and Kausar and Zaman (2011) specifically discussed the relationship between independent smallholders and intermediaries. However, these studies did not focus on supply chain flows, the factors that influence them, and the transfer

of custody of commodities from one actor to another. The flow and pattern of supply chains and buying and selling practices of independent smallholders' oil palm fresh fruit bunches (FFBs) involving informal actors are not widely known.

This study aimed to partly explore actors' roles in the supply chain flow of FFBs to CPO plant production in the Southeast Sulawesi Province. Secondly, the traceability of FFB supply chain of the independent smallholder will be covered throughout the study. The rest of this paper is structured as follows. Section 2 presents the literature review, explaining the traceability of the supply chain. Section 3 illustrates the qualitative investigation adopted in the interviews conducted and the data collection procedure. In Section 4, the results of the role of the actors involved in the FFBs supply chain are reported and discussed based on two sample sites, while Section 5 presents some implications of the analysis for stakeholders and policymakers.

2. Literature review

Food traceability is the ability to track a piece of food in batches or, more broadly, the history of it throughout the entire project, from harvest through transfer, storage, processing, distribution, sales, and internalization. This traceability is not a specific issue of the product itself but a problem that has been termed "Treacly." A quality control tool that should be systematically implemented is traceability, which records information about a product and its owner through tracking (Karsen et al., 2013). There are other definitions of traceability. ISO 9000 defines backtrace as the ability to trace the history, application, or location under consideration, which supersedes this standard (ISO, 2015). The Codex Alimentarius describes adherence to the movement of food, that is, having the ability to trace food through specified stage(s) of production, processing, and distribution (ISO, 2007). The General Food Law says that if an amount of food, feed, or substance is meant to be eaten or fed, it must be traced through all stages of production and distribution (Codex Alimentarius Commission, 2013; Olsen & Borit, 2013).

Every country has the option to increase the effectiveness and comprehensiveness of its tracking program with additional regulations. Europe is established as the leader and example to follow as its regulations are comprehensive (Charlebois et al., 2014). There are many benefits of authenticity in applying knowledge and skills such as information technology, electronics, biology, logistics, and supply chain management in the food industry. Quality, reliability, and precision can be increased through the use of traceability systems. These advantages impact how consumers are protected (Lupien, 2005; Souali et al., 2017). Consumers can trust the consumed products when they pay the correct price. It prevents health problems, improves the environment, and prevents invasions of nonnative species. (Walker, 2017). Opara (2003) stated that the demand for software that can reveal the location of organisms has been growing in the last few years due to developments related to genetically modified organisms. These situations reduce consumers' trust and increase their concern for the potential negative consequences of the current practices (Opara, 2003). As a preventative tool, a trace back system is beneficial in helping producers to manage the quality of food and identify and overcome threats to food safety. Information and communication technologies have increased the speed and precision of data collection and can present reliable and good information to consumers (Joao & Pedro, 2021). Part of the system will allow traceability to provide information on all production stages. All stakeholders—both those inside and outside the communication chain—need to have the ability to monitor and store data internally. Thus, consumers must know how their food is produced. This can benefit everyone in a lot of ways. Quality control and product diversity are essential to companies. Consumers will find it easier to make better decisions if they have more information about the limitations and factors they are looking for (Joao & Pedro, 2021). Moreover, according to Golan et al. (2004), the broadest definition for tracing back is that it has multiple objectives, and food is a complex product. At the very least, the descriptions of tracing and its classifications come from organizations, legislations, and research literature. In the food supply chain, two methodologies are used to build customer confidence and achieve quality and safety. There is always a quality improvement to raw materials before they reach consumers. Perishables such as produce, meat, and fish can change hands in different places before coming to a consumer (Óskarsdóttir & Oddsson, 2019). As food moves through the supply chain, it is difficult to ensure that it is safe and of good quality. A way of managing food provenance is called food "Tracey." It involves capturing, keeping, and distributing adequate information about a food or animal. A product must be checked in stages of the food supply chain so that it can be tracked and traced upward at any time for quality and safety (Bosona & Gebresenbet, 2013).

3. Methodology

3.1 Sample size

This study was conducted in Southeast Sulawesi Province with two sample districts—North Konawe and Kolaka. The selection of the sample districts was based on the oil palm land area and the number of independent smallholders in Southeast Sulawesi Province. The location of the CPO mill (the supply chain flow in this study) is PT Damai Jaya Lestari (DJL) in Tetewatu Village in Wiwirano sub district in North Konawe district and Polinggona Village in Polinggona subdistrict in Kolaka district. This study was conducted from November to December 2022.

3.2. Research Method

The research method used is food supply chain networking (FSCN), which is described to determine the flow of goods and services along the CPO supply chain (Fig. 1). This method combines both quantitative and qualitative methods. This FSCN method is carried out using observation, focus group discussion (FGD), survey, and interview techniques. The observation technique is a study to collect data and information related to the population and the research areas. This observation helps us to anticipate obstacles and constraints in the implementation of the research findings. The FGD is a follow-up to the results of field observations. The FGD also aims to collect qualitative preliminary data and information. The FGD involves resource persons, field instructors, oil palm farmers, business groups, or business actors engaged in the palm oil sector, related agencies, palm oil companies, and other relevant stakeholders. The survey aims to make the primary data qualitative by carrying out in-depth interviews with key respondents. Fig. 1 depicts a schematic representation of the traceability of the palm oil supply chain. There are three components of tracing. First, the origin and characteristics of a problem can be identified through tracing. Second, while back tracing can follow a product to gather information, downward tracing is more efficient and allows for more precise monitoring of the product's progress between points within the flow. Lastly, companies have a choice to perfect two types of tracing.

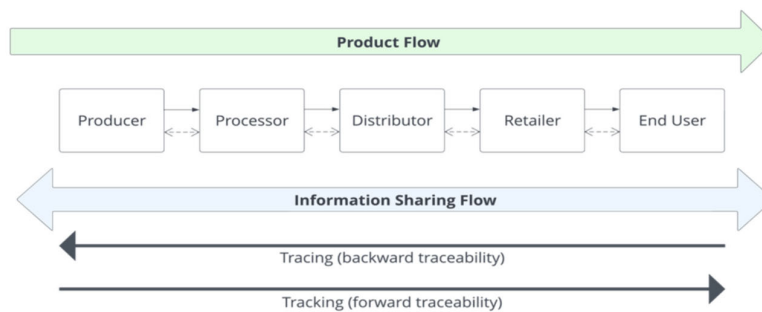


Fig. 1. FSCN Method of Palm Oil Supply Chain (Adopted from the study by Bosona and Gebresenbe, 2013)

3.3. Data Collection

The sample comprises respondents who are directly involved in oil palm business transactions from upstream to downstream. The respondents in the upstream sector include oil palm farmers and palm oil companies that produce FFBs, FFBs collection traders, and CPO processing plants. Probability sampling is employed in this study, using the proportionate stratified random sampling technique. Proportionate stratified random sampling is a technique that is used when the population has inhomogeneous elements (Zukhri, 2012). In addition, the snowball sampling technique was applied qualitatively because of the diversity of samples in the population, which is difficult to ascertain quantitatively. The selected respondents include 10 independent palm oil farmers and 3 collecting traders in Plasma Jaya Village, Polinggona district, Kolaka Regency, while in Tetewatu Village, Wiwirano district, North Konawe Regency, the selected respondents include 10 independent farmers and 2 collecting traders. The data collected will then be analyzed using the stakeholder analysis method. This analysis aims to map the involvement of all stakeholders in the supply chain network in the CPO industry. According to the Danube Transnational Program (2021), stakeholder mapping is a combination of process, research, and discussion that describes multiple perspectives to determine the key sequence of all existing stakeholders. Stakeholder mapping is also defined as a tool in business that is useful for assessing the impact of an individual or a group of stakeholders on a company (Walker et al., 2008). Thus, stakeholder mapping is needed by a company to support its success and sustainability. There are four stages in mapping stakeholders (Danube Transnational Program, 2021). The first stage is identifying or listing the parties directly related to the company (stakeholders), such as organizations and individuals. The list of stakeholders is further analyzed to understand their relevance, understand the reciprocal relationship between a company and its stakeholders, and provide priorities based on stakeholder interests. This analysis is expected to answer the research questions.

4. Results and discussion

4.1 The Performance of Independent Smallholder Plantation

Oil palm plantations in the research locations are generally planted under a monoculture system. Seeds are nurtured into seedlings for up to one year in nurseries until they become small plants and are then transferred to the plantation. During this period, the palm trees must be maintained through fertilization and protection from pests. After the fourth year, the palm trees bear fruit. Each tree continues to produce for up to 30 years and grows up to 12 meters in height. Oil palm fruits are solid

bunches weighing 10 to 25 kg and produce 12 to 14 bunches annually. Harvesting is done by cutting the fruit bunches using a very long scythe. After harvesting, the FFBS are loaded onto trucks or other means of transportation to a palm oil mill.

Palm oil mills receive FFBS from their core plantations, plasma plantations, and independent farmers. Some mills only accept FFBS from core plantations; a combination of core and plasma; core, plasma, and independent farmers; and various combinations of the three types of suppliers, depending on the circumstances and policies of each company. The FFBS from the trucks are unloaded in an open field before being processed in the mill into CPO. FFBS must be processed immediately within a maximum of 48 hours for excellent quality. At the mill, FFBS are processed into CPO. The CPO produced from the mill is then sent to refineries either at home or abroad, which are then turned into various products such as soap, margarine, biscuits, and biofuels by different factories and companies.

The best seed for producing palm fruits with the highest oil extraction yield is “tenera,” which is a cross between “dura” and “pisifera” seeds (Woittiez, et al. 2016). Tenera has a thin shell with large fruit bunches, while dura, despite having large bunches, has a thick shell that can damage the mill machinery and produce little oil. Pisifera, which has no shell, is sterile and produces almost no fruit. To be sure that the plants planted on their farms are tenera, large companies buy seeds from seed producers for farmers. Many independent smallholders in the research locations still do not understand or cannot access tenera seeds, so many still plant dura.

Differences in FFB quality affect the purchase price of FFB at the mill. The mill carries out sorting and grading, where every incoming third-party FFB supply must go through this process and receive a “grade.” Each grade has a different price level, and the price difference between core/plasma FFB grades and that of independent smallholders can reach 300–500 rupiah per ton. For the mills, the FFBS from tenera plants are highly preferred, whereas for smallholders, it is not so important. First, tenera seeds are not easily available and are expensive. There are also many cases of seedling forgery, so even farmers who want to plant good seedlings can be trapped into planting dura seedlings. Second, farmers’ FFB purchases are calculated based on tonnage, while dura FFB is usually heavier in weight than tenera. Despite the poor grading, farmers still feel as if they are getting more money from tonnage. However, most of the oil palm trees that have already been planted are dura seedlings, so to change the quality of the FFB, the plants must be replanted. As oil palm trees only become productive after a few years, farmers may lose income from FFB sales within the first few years after replanting. Thus, replanting is not an easy task for independent smallholders. The quality derived from plant species is not the only thing that determines grading. Harvesting must be done at the right time to ensure that the fruit is ripe (not shriveled), and the fruit stalk must not be long to ensure that the weight calculated is the weight of the FFB and not the stalk. Thus, in addition to seedlings, knowledge of harvesting and supervision is needed to ensure excellent FFB quality.

4.2 Mapping Supply Chain of FFBS’ Independent smallholder farmers (the role and the traceability)

North Konawe District

PT DJL is a private company that has three palm oil mills spread across Southeast Sulawesi Province, namely North Konawe, Kolaka, and Konawe. In North Konawe, the palm oil mills plantation is called PKS Ganda Makmur and has a palm oil to CPO processing plant that manages the supply of FFBS from its third parties centrally with a special department that is divided per region and manages contracts with suppliers, arranges how much volume of FFBS to send to each of their mills, and makes payments for FFBS purchases. The mills are only in charge of receiving, weighing, and sorting FFBS, as well as reporting the delivery volume to this department. This department has offices in each region with employees in charge of handling third-party suppliers daily.

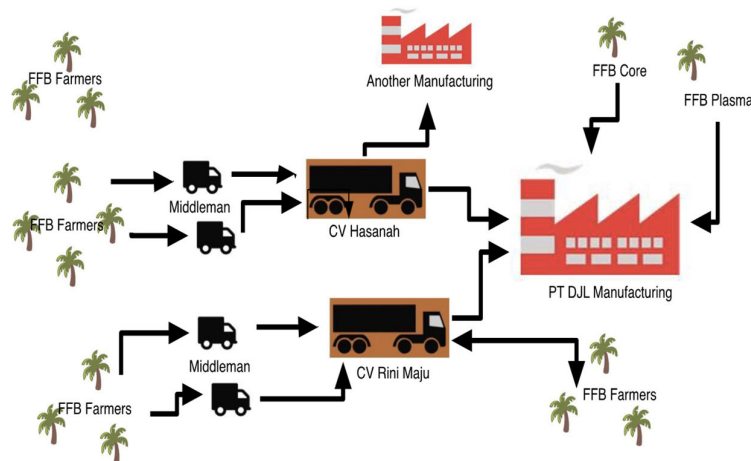


Fig. 2. Mapping of Supply Chain of FFBS’ Independent Smallholder in North Konawe District

FFBs supply to PT DJL's CPO processing plant comes from nucleus, plasma, Government Company of PTPN XIV and independent smallholders as well as Surya Prima Lestari located in the Andowia subdistrict, North Konawe district. Private company of DJL has two FFB platforms that supply them, namely CV Karya Mandiri and CV Samurai (the largest one is CV Karya Mandiri). A platform, also known as a depot or "ramp," is a place that holds FFBs sold by independent smallholders. It is often called "ramp" because this place has a weighbridge for trucks in the form of a ramp. CV Karya Mandiri is one of the FFB trading companies recruited by PT DJL to supply FFBs to their mills. CV Karya Mandiri has a contract with PT DJL and, as such, is entitled to a fruit delivery letter (SPB), which is commonly known as a delivery order (DO). The company not only delivers FFBs to PT DJL but also delivers to another mill on the border of Central Sulawesi and Southeast Sulawesi. Fig. 2 depicts the traceability of the palm oil supply chain in the North Konawe district.

CV Karya Mandiri collects FFBs from their suppliers at a ramp located on the side of a large road. Their weighbridge is equipped with digital software. Each incoming truck is weighed, sorted, and receives payment in cash, and the FFBs are unloaded in a yard. CV Karya Mandiri then reloads the FFBs onto their trucks for delivery to their clients' mills. CV Karya Mandiri supplies the two mills with approximately 80 tons of FFBs per day. FFB supplies from the farmers are either delivered by the farmers themselves or picked up by the company. CV Karya Mandiri is also a supplier to another mill in the border area of Central Sulawesi and Southeast Sulawesi. This mill is categorized as a mill that does not have a plantation, and the price of FFBs to this mill has a considerable price difference around IDR 300 to IDR 500. This price is lower than DJL Company.

Kolaka Regency

The supply chain flow of the CPO industry in Kolaka Regency starts with the supply of FFBs from independent smallholders, DJL's nucleus, and DJL's plasma, which has 11,000 hectares of plantations in Polinggona and Tanggetada subdistricts, where approximately 70% of FFBs supply comes from DJL's nucleus and plasma, and the rest comes from independent smallholders and other plantations. The supply chain of independent smallholders in Kolaka Regency starts from when oil palm FFBs are harvested in the smallholders' plantation to the mill. A comparison of the similarities and differences in the three research sites reveals a common pattern of the main roles of independent oil palm smallholders in the FFBs supply chain. Although there are variations in the flow and process as well as the number of supply chain stages, in general, the supply chain of independent smallholders can be simplified into four stages—PT DJL Palm Oil Mill (PKS), DO holders, collectors, and smallholders. Collectors can be agents/middlemen who go around buying and collecting farmers' fruits or a group of farmers that collects and transports their harvest together. The roles of the parties can overlap, such as farmers who also act as collectors or DO holders who also act as collectors.

The PKS in Kolaka district is the last link in the chain to receive farmers' FFBs before the product is turned into liquid CPO. Palm oil mills can receive FFBs from different parties, including their own nucleus plantations, assisted smallholders, and third-party suppliers, which can be medium-scale plantations or independent smallholders' FFBs from intermediaries. FFBs arriving by truck are weighed and unloaded in an open area for sorting and then proceed to enter the mill process. Each arriving truck must carry a document commonly called an SPB or DO. DOs are only owned by parties who have a contract with PKS (the company). Each truck is weighed, and a weighing slip is issued to indicate the volume of FFBs carried by each truck. The sorting area is where all incoming FFBs are unloaded. Generally, the FFBs are not grouped based on their origin, but usually, FFBs from third parties are sorted more thoroughly. After that, the FFBs are loaded onto the lorry to start the FFB to CPO process.

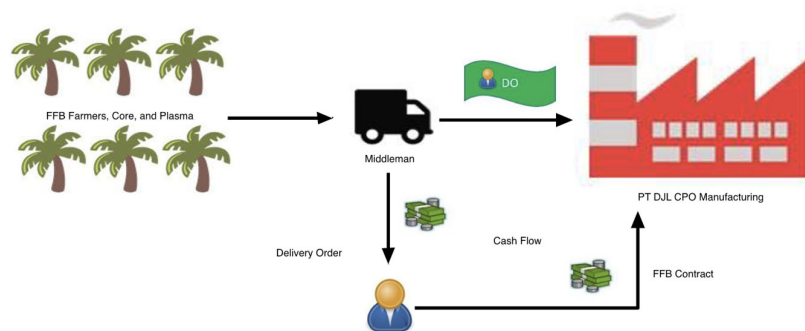


Fig. 3. Mapping of Supply Chain of FFBs' Independent Smallholder in North Konawe District

As mentioned, three parties can supply fruits to PT DJL's mill in Kolaka Regency, namely, their own nucleus plantations, plasma smallholder plantations, and independent smallholder plantations. Among these three types of suppliers, PKS

prioritizes supplies from core and plasma plantations because in addition to the obvious responsibility of processing their own fruit supplies, the quality of core/plasma FFBS is good, while FFBS from third parties, especially independent smallholders, are of less quality due to seedling and harvesting issues, as explained in the previous section. The presence or absence of a nucleus/plasma fruit supply determines whether or not a mill/company will purchase FFBS from independent smallholders and how onerous the requirements will be to accept the supply. MCCs with sufficient fruit will be choosier about FFB quality, delivery volume, and payment terms, while companies that are in dire need of smallholders' fruits will apply easier requirements (Fig. 3.). Furthermore, DO holder is the term used to refer to persons who have a contract with the mill/company and thus hold DO or SPB, which accompanies each delivery of FFBS to the mill. DO is a document that serves as the only entry ticket that allows the supplier to deliver FFBS to the mill. DO authorizes a party to be a supplier to a mill. Without a DO, FFBS will not be accepted at the mill. The company makes a contract with trustworthy people to be FFB suppliers, and based on the contract, they can make a blank DO as proof that they are registered suppliers in the company. A DO holder may be an owner of a large plantation that supplies the mill directly or a supplier who collects the harvest of independent smallholders. In reality, FFBS are delivered directly to the mill by collectors under a DO holder. A DO holder gives the DO to the collector so that the FFBS can be received at the mill. After delivery, the farmer or agent will invoice the DO holder based on the weight of the FFBS at the mill, which is usually paid directly in cash by the DO holder. Then, the DO holder will collect the payments for all FFBS delivered at the mill. In this type of operation, apart from having a network of trust with the company, the DO holder should also have cash to make advance payments for FFBS.

In Kolaka district, collector or middleman is the term used for both agents who go around buying farmers' FFBS and farmer groups that agree to sell and transport their harvest together. A farmer group is a group of farmers who agree to synchronize their harvest schedules so that their crops can be collected and transported together. The sales proceeds are shared among themselves based on the tonnage of each harvest after deducting transportation costs and considering the grading results. Agents and farmer groups are categorized in the same level of the supply chain because they play the same role, which is to aggregate the harvest volume to reach the appropriate amount to be transported efficiently to the DO holder. This means that agents or farmer groups are responsible for picking up the harvest from the harvesting location to the next supply chain location. Although an agent is someone whose business is to pick up and buy and sell FFBS, it does not rule out the possibility of a farmer delivering the harvest to the agent's house or the farmer group's headquarters. Agents are sometimes referred to as middlemen, collectors, or "geckos."

Collectors usually collect small harvests such as those from two or three palms planted in a yard. The agents pay the collectors directly in cash based on the weight of the fruits. Collectors (agents and farmer groups) may deliver directly to the mill by borrowing the DO from the DO holder or deliver to the DO holder. An agent or a collector may be a farmer in a village who decides to buy and transport FFBS of other farmers around his farm or house; an agent or a collector can also be a professional trader who travels around in trucks to look for fruits to buy. The nature of the two types of agents' social relationship with farmers is very different. Agents who are local villagers have a good social relationship with farmers beyond just trading with them. Agents who are traveling traders only have a buying and selling relationship with their customers.

5. Conclusion

Based on the results of this study, the following conclusions are drawn.

1. The results of this study reveal that although the supply chain flow of independent smallholders has some variations, the characteristics can still be generalized. The findings from the two research locations in Southeast Sulawesi Province and other islands in Indonesia reveal patterns that can be generalized in terms of the existence of actors, the role of each actor, and the interaction between these actors in the supply chain. We can conclude that there are four levels of actors in the supply chain—mills, DO holders, collectors, and farmers—with different levels and types of traceability risks.
2. The results of the supply chain traceability in the two districts of Kolaka and North Konawe reveal that the flow of FFBS supply in the two districts is not much different, but there is diversity in their FFB sales. FFB sales in Kolaka Regency vary greatly as it involves several agents or collectors and middlemen with profit-seeking goals who sell FFBS to mills at different prices. In the supply chain flow, traders seek large profits when selling to the several mills in the Konawe district, which generally do not have a plantation. However, in the North Konawe district, FFB sales are mainly to PT DJL and mills that do not have plantations on the border of Central Sulawesi.
3. Waste products such as empty bunches can be used as organic fertilizer and animal feed. However, it appears that the companies do not process the waste products, and the ability of independent smallholders in the two research locations to utilize the waste products is very limited. Therefore, in terms of the green economy aspect of oil palm plantations in the two research locations, waste products have not been fully utilized by companies and independent smallholders.

4. The inclusion of independent smallholders by the companies is still limited as oil palm plantation companies only pay attention to their plasma smallholders as they are bound by contracts and agreements. The weak inclusion of independent smallholders is demonstrated by the absence of company guidance to independent smallholders, although FFBs supply also comes from them. In addition, independent smallholders are not institutionalized into oil palm farmer groups, which puts them in a low bargaining position when dealing with palm oil mill companies.

Competing interest

No competing interests were disclosed.

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Authors' Contribution

J. Witjaksono did conceptualization, investigation, and writing original draft preparation. Umi karomah and Deden Djaenudin contributed conceptualization, and writing-review and editing. Satria Astana, Alfonsus and Samuel Fery interpreted writing-review and editing. Abdul Muis, Husnul Khotimah and Achsanah did conceptualization, writing-review and editing. Rusdin, Bungati, Rusdi and Resmayati Purba designed methodology, writing review and editing. All authors read and approved the final manuscript.

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