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Corporate farming model for sustainable supply chain crude palm oil of independent smallholder farmers

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Independent oil palm smallholders in Indonesia contributed significantly to the sustainable of Crude Palm Oil (CPO) supply chain. On the other hand, sustainability in the process of implementing the supply chain system for independent smallholders is an issue that is extremely important for the success of the supply chain system for the CPO company. This study's objective is to develop an alternative business model with the goal of strengthening the interaction that already exists between independent farmers and cooperatives in ensuring the existence of a supply chain for raw materials and having access to financial resources, knowledge, and technology. The selection of the research location considered several factors, including the size of the area's oil palm plantations, the number of oil palm farmers who are self-sufficient, and the possibility of locating CPO plant. Study findings that, the new model by business canvas analysis as the upgraded model of existing model business recommended that it should be built based on the cooperative palm oil family which provides farmers with access to financial, replanting, intensification, and extensification and infrastructure by APKASINDO, BPDPKS, Bank, and other stakeholders to sustain the FFB supply chain in cooperation through a partnership program in a long-term scheme. This whole system was developed by corporate farming system based on the cooperative as the off taker of FFB farmers and develop mini plant CPO to produce cooking oil and biofuels and by product as the waste management system as the value added for farmers.

KEYWORDS

independent, smallholder, palm oil, cooperative, corporate farming, fresh fruit bunches, business model

1 Introduction

Indonesia is the world's leading producer and exporter of palm oil, making it the dominant player in the global palm oil market. Indonesia was by far the world's largest producer and exporter of palm oil. Together with Malaysia, they account for roughly 85 to 90 percent of total worldwide palm oil production, accounting for nearly all of the world's palm oil production and exports. Unlike Malaysia, which exported the majority of its palm oil, Indonesia was a major user of palm oil, using it as both an edible oil and in biofuels (Raharja et al., 2020). A significant contributor to Indonesia's economy is the palm oil plantation and processing sector of the industry. The exportation of palm oil is a significant source of foreign currency, and the palm oil business provides employment possibilities for millions of people in Indonesia. The production of palm oil in Indonesia is the most significant sector of the country's agricultural economy, accounting for between 1.5 and 2.5 percent of the country's gross domestic product (GDP). According to the statistics presented in the 2018–2020 Indonesian Plantation Statistics publication that was published by the Ministry of Agriculture in 2019, the total area of oil palm plantations in Indonesia reached 14,326,350 hectares. According to the Ministry of Agriculture's 2019 statistics, private firms cultivate 55.09 percent of the land, which amounts to 7.892.706 hectares; smallholder plantations cultivate 40.62 percent, which amounts to 5,818,888 hectares; and state companies cultivate 4.29%, which amounts to 614.756 hectares. Since they possess a very small number of plantations, state-owned firms in Indonesia's palm oil industry play only a very little role in the industry. Meanwhile, large private companies have become the main force in the palm oil industry in Indonesia, producing somewhat more than half of the entire output. Around 40% of the world's food supply comes from family farms and other small operations.

Oil palm farming is one of the farms established by the community as a whole, particularly in rural regions. This farm plays an essential role in raising community income (Pitriani et al., 2019), particularly for communities that are in rural areas (Siradjuddin, 2015). According to the available evidence, the palm oil business serves an important function by acting as a primary generator of economic growth, as well as a significant source of foreign exchange and state revenue. This demonstrates that oil palm farming conducted by smallholders and the enterprises that are directly and indirectly dependent on it are economic locomotives at the national and regional levels. According to Purba (2019), an increase in oil palm production may influence the growth of regional gross domestic product (GRDP) and may also have an effect on the growth of regional economic development. The findings of Wisena et al. (2014), the growth of community oil palm in different regions of Indonesia has a meaningful impact on the improvement of community welfare and is able to maintain the balance of natural resources and the environment. The idea of partnership-based smallholder oil palm agribusiness development can contribute economically toward increasing farmers' income and welfare (Kospa, 2016). This concept also contributes to the realization of a good farming and agricultural system, and it has an impact on the welfare and development of the farmers' lives themselves. In accordance with Pasaribu et al. (2013), the establishment of farmer groups in villages based on the agricultural potential of the village can play a role in boosting the welfare of oil palm farmer households, as well as the growth of oil palm agribusiness firms.

To overcome limitations and at the same time facilitate farmers entering the palm oil business, Indonesia is developing ecosystem innovation in the form of policies and institutional cooperation between farmers and corporations which are known as partnership institutions. One form of this partnership is the Community Core Plantation (PIR) model. In the PIR pattern, state plantations (BUMN) and private plantations act as the core, while the surrounding farmers are plasma. This partnership pattern is called the Core-Plasma partnership. In fact, this partnership policy is accepted by investment actors as an ecosystem that provides certainty for investment in palm oil plantations, so that investment in palm oil plantations increases from year to year. The Inti-Plasma partnership pattern is also able to attract millions of farmers in each region to enter the palm oil business, even though not as plasma. These non-plasma oil palm farmers are then referred to as independent smallholders. The mention of self-help or independence is because these farmers are able to develop their oil palm plantations with their own initiative, self-financing and self-learning from plasma farmers around them or from farmers who have been successful before. These independent oil palm farmers are growing faster and more widely. Around 80 percent of the area of smallholder oil palm plantations is the area of oil palm plantations owned by independent oil palm farmers. It is these independent oil palm farmers who are driving the revolution in smallholder oil palm plantations in Indonesia (PASPI, 2021).

As actors further upstream in the supply chain, smallholders play an important part in the process of integrating the supply chain as a whole to solve problems related to sustainability and boost production. Today, the industry that produces palm oil in Indonesia is dealing with a few sustainability concerns that provide a challenge for all of the actors along the supply chain, but notably for smallholders in their capacity as producers. Additionally, the percentage contribution of smallholders reveals that independent smallholders play an essential part in the global supply chain for CPO (Crude Palm Oil). This is shown by the fact that the percentage is 40%. The policy of developing partnership patterns in oil palm plantations has succeeded in opening up access for farmers to enter the oil palm plantation business. The main actors who brought about revolutionary change in Indonesian people's oil palm plantations were independent oil palm farmers with an independent financing system that did not burden the government budget. The people's palm oil revolution has also improved the lives of 2.5 million farming families or brought around 10 million people out of poverty so that their welfare has also increased (PASPI, 2021). Despite this, the existence of independent smallholders is still plagued by a number of issues, including non-optimal smallholder institutions, low production and quality of FFB compared to nucleus and plasma smallholder production, supply chain dependence on middlemen, market distortions, weak access to markets, capital and information, technology, and weak development of business models based on partnerships with the industry (Mwangi and Kariuki, 2015; Santika et al., 2019; Permatasari and Suryani, 2022; Sahara Dermawan et al., 2022; Witjaksono et al., 2023).

The challenges faced by the Indonesian palm oil and the climate change are special concerns to Indonesia. In APEC 2013 meeting in Bali, Indonesia, it was obvious that palm oil was hardly accepted to be listed in the Environmental Goods. On the other hand, climate change has become a global concern, and it is not detachable from the palm oil. Social-related issues such as food security, social conflicts, and the loss of biodiversity are built-in challenges in the development

of oil palm plantations in Indonesia. Sustainable Palm Oil for a, both RSPO (Roundtable on Sustainable Palm Oil) or ISPO (Indonesian Sustainable Palm Oil) are existing for quite a while to promote the Sustainable Palm Oil in the whole producing countries of palm oil. One of the barriers to conquering the problems is market dependency on the corporates in the palm oil's supply chain. The smallholders' role in the supply chain is to produce palm oil in their small plantation and deliver the yields to palm oil processing mills. These are motives for the government and the business players to create new platform and redesign the management system of oil palm plantation in Indonesia (Mansuetus, 2013).

The issue of sustainability for the implementation of the supply chain system for independent smallholders is a basic concern, and it is very crucial for the success of the supply chain system for the CPO business, both for cooking oil and biodiesel supply. Further issues affecting the upstream sector as a supplier include productivity inequality between large plantations and independent smallholders, the welfare of independent smallholders, low FFB quality due to non-Good Agricultural Practice (GAP), and environmentally unfriendly plantation management. The issues are faced in partnerships between independent smallholders and CPO supply companies. Independent smallholders are currently facing a challenge in the form of a gap in the sales of raw materials to large palm oil mills. This is because large firms have their own plantations, which is preventing the independent smallholders from selling these resources. In addition, the remote placement of large-scale mills creates another challenge for independent smallholders, which is the gradual decrease in their income caused by the extensive distribution chain. The challenge of sustainability for the implementation of the supply chain system for independent smallholders is a basic concern, and it is highly vital for the success of the supply chain system for the CPO business, both for cooking oil and biodiesel supply. This is due to the subject of sustainability for the implementation of the supply chain system for independent smallholders is an essential consideration. Inequality in productivity between large plantations and independent smallholders is another problem that plagues the upstream sector as a supplier. Further challenges include poor FFB quality because of non-Good Agricultural Practice (GAP) and environmentally unfriendly plantation management. In cooperation between independent smallholders and CPO supply firms, the challenges are encountered on a regular basis. Independent smallholders are today confronted with a problem in the shape of a gap in the sales of raw materials to large palm oil mills. This gap has created a difficulty for the independent smallholders. This is because huge companies have their own plantations, which prevents independent smallholders from selling these resources. In addition, the dispersed location of large-scale mills presents a further obstacle for self-sufficient smallholders in the form of a slow but steady decline in their revenue, which is a direct result of the broad distribution network.

The tradeoff between future energy needs and the transition to renewable energy such as biodiesel from palm oil FFB and food sovereignty transition to renewable energy is a challenge that must be anticipated immediately. This is due to the use of palm oil resources as both an energy source and as a food source (Koizumi, 2015; Naylor and Hggins, 2018). In addition, it is important to emphasize that independent smallholders are also a part of the global supply chain for both biodiesel and food (cooking oil), both of which are still experiencing challenges, particularly in terms of the institutional strengthening of smallholders (Ullah et al., 2015; Woittiez et al., 2017; Asiela et al., 2018; Raharja et al., 2020). A partnership formed through financial institutions or farmer corporations that places an emphasis on the business model is one of the strategies that is being implemented to further increase the role of independent oil palm smallholders. Farmers have a better bargaining position, market access, capitalization, and technology, increased production, and more inclusive supply chains, in accordance to the findings of a number of studies (Effendy and Mustofa, 2020; Gultom et al., 2020; Setyawan et al., 2020; Haryanto et al., 2022). The results obtained are based on the development of a business model for corporate farming.

This study is vital as part of an effort to strengthen the role of independent oil palm smallholders by putting an emphasis on the establishment of a business model based on corporate business partnerships of oil palm smallholders. The purpose of this research is to establish an alternative business model in the hopes of enhancing the interaction that exists between independent farmers and cooperatives. This construction of a business model includes the assurance of a supply chain for raw materials, production continuity, product quality, access to finances, knowledge, and technology. These components must be based on a partnership model that is put together jointly by the agricultural community and the corporate farmers. Consequently, the business model is vitally important so that the farmer corporation institution can get stronger. This will give a guarantee for the business model's continued viability and will also increase the welfare of farmers. In this investigation, the establishment of a business model that is based on partnerships needs to happen to generate a synergy between independent smallholder groups and industry. This is critical to maintain independent smallholder business enterprises in the CPO supply chain to support the distribution system for cooking oil.

2 Methodology

2.1 Theoretical model

2.1.1 Business model canvas

Farmer corporations, as economic organizations for farmers, require strategies that are adaptable to the surrounding conditions and markets in order to successfully manage their operations. As a result, a business model that can describe the current business environment in great detail is required. A corporation's ability to supply, collect, and generate value for customers is reflected in its business model (Maghfiroh, 2021). This process improves the performance of the company's goods and services and eventually boosts earnings (Osterwalder and Pigneur, 2010; Maghfiroh, 2021). The framework known as the Business Model Canvas (BMC), which was established by Osterwalder and Pigneur (2010), is a frequently employed business model in practice. The Business Model Canvas (BMC) is a comprehensive framework utilized to depict, evaluate, and formulate the business model of an organization.

This model encompasses nine fundamental components, namely value propositions, customer segments, customer relationships, channels, key resources, key activities, key partnerships, cost structure, and revenue streams (Osterwalder and Pigneur, 2010; Pratama and Azis, 2018; Strulak-Wójcikiewicz et al., 2020; Montenegro et al., 2021). Simple, pertinent, and intuitive, the business model concept should

not oversimplify the complexity of the company's operations (Mahdi and Baga, 2018; Herawati et al., 2019). It should additionally tackle the challenges facing the organization (Mahdi and Baga, 2018; Samsiar et al., 2021), making it apparent what business managers can accomplish (Pratami and Wijaya, 2016). The task is carried out by individuals in managerial positions within the corporate sector (Pratami and Wijaya, 2016).

Numerous scholarly investigations have also been undertaken to examine the use of the business model canvas (BMC) as a tool for strategic formulation. The business model described is commonly employed by organizations in the early stages of market entry, throughout the development phase, or when the organization needs enhancement (Mustika Ratnawat and Silfi, 2017). Boedianto and Harjanti (2015) and Hudori (2015) both did study on business growth strategies utilizing the Business Model Canvas (BMC) as their analytical technique. According to the findings of Boedianto and Harjanti's (2015) study, key relationships emerge as the most crucial factor, as the significance lies in the interdependence and connection between the primary partners. Contrarily, according to Hudori's research findings, in order to leverage robust industry fundamentals, it becomes imperative to pursue expansion in upstream as well as downstream sectors. Hence, it is imperative to do this study in order to provide the farmer firm with insights into the strategic positioning of the company and its commercial development via the commercial Model Canvas (BMC) approach. The objective of the BMC is to identify the execution of established business models and the formulation of business strategies (Boedianto and Harjanti, 2015). Furthermore, the Business Model Canvas (BMC) also examines the business model pertaining to consumer groups, value propositions, distribution channels, customer relationships, sales growth, and product service (Wiska et al., 2016). The utilization of the Business Model Canvas (BMC) in the analysis of a business model can enhance its overall strength and facilitate a more effective evaluation of the integration of company development strategies. The use of the BMC framework yielded multiple potential business growth strategies for the firm in question, with the cooking oil industry and biodiesel industry serving as its business partners.

2.1.2 Corporate farming

Corporate farming is a form of agricultural endeavor in which two or more parcels of land are combined and farmed under the supervision of a single farmer. This agrees with the opinion of Mustofa and Kurnia (2018), who state that the practice of merging agricultural land jointly held by farmers and integrated into one government is what is known as corporate farming.[1] This is in accordance with the opinion of Mustofa and Kurnia (2018). Inefficiencies in the marketing process are caused when there are a large number of middlemen in the supply chain for agricultural commodities. This has repercussions for both the producers and the consumers, since it results in lower selling prices for the producers and higher purchase prices for the consumers. Meanwhile, traders made a profit from the situation. Since of this, farmers are unable to raise their revenue since they are constantly subjected to price pressure from traders, and their position around the bargaining table is weak. As a result, it is essential to streamline the process of product distribution to reduce the number of participants or intermediaries involved in the marketing chain. The implementation of corporate agriculture as a means of making food marketing more effective through the coordination of various actors within a framework is one way to circumvent this challenge. Because corporate agriculture typically involves selling goods directly to global or international markets, farmers may also see a boost in their revenue because of the practice. This type of corporate agriculture also has the potential to restore the declining levels of global food security. Through the utilization of corporate land, corporate agriculture also has the potential to foster the development of farming businesses that are autonomous, competitive, and self-sufficient. This form of corporate farming is accomplished by using resources in an effective and efficient manner, taking use of optimal opportunities presented by institutions, and is also capable of being adapted to rural regions through the use of a modern agribusiness model. According to Nuryanti (2005), who is of the belief that the corporate farming model may effectively aid farmers, this agrees with their viewpoint. The use of operational partnerships is one way to get over limitations imposed by capital. The integration of production facilities, simultaneous cultivation models, technical homogeneity, integrated post-harvest marketing, and structured marketing are some of the ways that agricultural efficiency goals can be met. Because there will be no land management, the individual land ownership rights of each farmer will not be infringed upon.

The utilization of agricultural land and farmers by corporate farming can, in fact, result in very productive outcomes. The presence of corporate farming also has the potential to boost the revenue of groupings of individual farmers. In addition, the implementation of corporate agriculture as a method for the government to boost the income of farmers in rural regions is something that may be done. However, there are numerous issues with corporate agriculture, which makes it difficult for farmers to put it into practice. Because corporate farming needs a lot of money and enough labor, it is often strongly tied to the developments of global markets, particularly if it uses monoculture agriculture. This is especially the case when there are issues about market imbalances. These issues might bring about a loss in firm income, which in turn can bring about a decline in the economics of farmers. Corporate farming is a form of economic collaboration between farmer organizations and agribusiness-oriented companies that involves keeping the ownership of each farmer's land. This type of farming is also known as collective farming. The adoption of corporate agricultural practices can be of assistance in the standardization of quality, the improvement of business efficiency, and the enhancement of resource management. Corporate farming can be defined as the combination of land that is collectively managed with land that is controlled by a single entity. The objective of corporate farming is to establish an agricultural enterprise that is autonomous, sustainable, and competitive with corporate land management. Additional economic benefits received include the ability to lower manufacturing costs, improve production scale, and boost member income. Meanwhile, on the social front, corporate farming has the potential to improve levels of collaboration amongst its members, rekindle rural development, and make it easier for rural people to receive an education.

The accessibility of land for use as an agricultural input is a necessary precondition for the development of a viable agricultural sector. Although land area is fixed in nature, in the sense that the

1 https://iaas.or.id/get-to-know-what-corporate-farming-is/

total land resources of an area are fixed, land continues to play a key role in regional development, population expansion, and economic growth (Zakaria et al., 2022). This is even though land area is fixed in nature. Not only is there a limited amount of land resources, but there is also fragmentation, which is difficult to avoid due to the system of hereditary culture that develops among farmers. This contributes to the scarcity of land resources. According to Asiama et al. (2017), land fragmentation is a barrier to the growth of agricultural practices. According to (Liu, 2020), it is challenging to implement agricultural modernization and mechanization on land that is fragmented and narrow. In addition, fragmentation leads to a decline in the production of productive land, which results in an increase in the costs that must be borne by farmers in order to achieve potential production. This leads to a higher cost of production. The implementation of corporate farming is one method that can be used in the fight against the alteration and fragmentation of land usage. According to Mustofa and Kurnia (2018), corporate farming is the practice of combining multiple paddy fields into a single operation that is overseen by a single managerial entity. In this scenario, the farmer will become a shareholder in proportion to the amount of land that they own; hence, the distribution of the results will be determined by the amount of land that was owned. In the meanwhile, personal management is used for individual agriculture. Therefore, intensification through corporate farming is a strategic move since boosting production through extensification is not achievable. This is especially true given the high level of land fragmentation and the transfer of land to activities other than agriculture. In addition, technology can help reduce the expenses of farming, even though agricultural labor is still accessible, albeit in small numbers (scarce), and that wages are relatively high, despite the fact that farmers have limited access to financial resources. According to Iskandar and Jamhari. (2020), the model of corporate farming is more efficient than the conventional method of farming.

Actions designed to empower farmers themselves need to be carried out as part of the efforts to solve the difficulties that are now being experienced by farmers. According to Mustofa and Kurnia (2018), there are four significant things that can be done in order to empower farmers. These things are as follows: first, taking into consideration the extent and status of agricultural land tenure as a fundamental agricultural problem; second, the structuring of the system and structure of the allocation of agrarian resources is very important; and third, recognizing that the diversity of agricultural production systems is a fundamental agricultural problem. As a result, the spirit of agrarian reform, with land reform at its core, must remain on the agenda for the growth of agriculture. Reform must therefore remain on the agenda for the development of agriculture. The availability of information comes second. The fact that the community is aware of its "right" as a citizen to participate in the process of determining and controlling the policies that are issued by the legislative and the executive branch is the single most essential piece of knowledge that the community possesses. The third point is regarding involvement and inclusiveness. The answer to the question "who?" in this context is farmers, whereas the answer to the question "who?" is related to the concept of participation. The answer to the question "who?" is farmers, and the question "how?" is related to participation. The fourth point is increasing the local organizations' capabilities to establish their own capacity. Based on the four significant things that can be done to empower farmers, which have been outlined and described above, "corporate farming" can be utilized as a solution for overcoming the numerous challenges that are faced by farmers, which have been outlined and described previously.

Furthermore, according to Mustofa and Kurnia (2018), the definition of corporate farming is "the activity of merging farms to be managed jointly by farmers." Activities to be managed jointly by farmers and integrated under one management are also included. The primary objective of corporate farming is to conduct agricultural production as a business enterprise, aiming to maximize profitability and operational efficiency. This is due to the main constraints in the agricultural sector in Indonesia particularly independent oil palm smallholder farmers is the scattered land types caused by inheritance systems, land buying and selling, infrastructure development, and others. Therefore, one way to solve the problem of land fragmentation in Indonesia is through corporate farming. As the consequences, corporate farming needs to be developed to integrate a series of plans and implementation of policies, programs, activities and budgets and encouraging aspects of farmer empowerment to form a comprehensive unit from the perspective of the Farming Business system of independent oil palm smallholder farmers. This is line with White (2013) observed three aspects of agricultural development in Indonesia, namely, food security and future paths of agricultural growth, employment and particularly youth employment, and sustainability to investigate if Indonesia should develop large scale farming or corporate farming. He argued the types of farming considered as the most efficient in social and economic terms should satisfy conditions such as: promoting enhanced production (yields per hectare), maximizing labor absorption and provision of livelihoods (per hectare), better income distribution, and environmentally sustainable as well.

2.2 Study area

In the province of Southeast Sulawesi, the study was carried out in the Konawe District as well as the South Konawe District. The size of oil palm plantations, the number of independent oil palm farmers, and the potential for establishing biodiesel facilities in Southeast Sulawesi were taken into account while choosing the regions for the investigation. This ensured the most accurate results. The task at hand was carried out for close to three (three) months, from June 2023 till September 2023.

2.3 Sample of respondent

The sample comprises respondents who are directly involved in oil palm business transactions from upstream to downstream both in Konawe and South Konawe Districts. The respondents in the upstream sector include independent oil palm farmers, palm oil companies that produce FFBs, FFBs collection traders (middlemen), 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 (Watts et al., 2021). 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 15 independent palm oil farmers and 5 collecting traders in Konawe Districts, while in South Konawe Regency, the selected respondents include 10 independent farmers and 2 collecting traders.

2.4 Data collection methods

In the frame of this investigation, data were gathered by means of in-depth interviews as well as Focus Group Discussions (FGD). The in-depth interviews focused on key individuals and organizations at each stage of the supply chain. These incorporated a random selection of 10 smallholder oil palm farms, key traders and smallholder cooperative institutions, and local governments in the Konawe and Sout Konawe Districts. A focus group discussion (FGD) was carried out since the design of the institutional framework for the palm oil business required extensive reasoning from a variety of perspectives. We conducted FGDs three times in each district, along with supply chain stakeholders (companies or traders holding delivery orders (DO) to Palm Oil Plantations (PKS) as CPO processors), related agencies, local governments, and institutional experts attended each of these meetings. The respondents and experts for the FGD were chosen using purposive sampling since their participation in the model, comprehension of the issue, and capacity to advocate for and have an impact on the institutional model were all important considerations in the selection process. The phase of the expert selection that determined the validity and dependability of the data was also the phase that provided any argumentation and evaluation that was needed for this research. In addition, the outcomes of the final conceptual model were re-validated by the expert group during the third round of focus group discussions (FGDs).

The initial FGD was convened in both the Konawe and South Konawe districts with the goals of identifying existing issues in the palm oil supply chain, collecting information relating to those issues, and putting out a comprehensive plan for bolstering palm oil smallholders. During this phase, participation from all relevant stakeholders was required, including but not limited to smallholders, traders, and palm oil mills from each district. During the second FGD, researchers and industry experts explored the development of an acceptable conceptual model to address issues that arise in the actual world. The real-world issues that were identified during the initial FGD were dissected and studied so that suitable solutions could be developed. In the end, the institutional model was presented to various stakeholders in Konawe during the third FGD, and South Konawe District obtained responses that strengthened the model.

2.5 Data analysis

The Business Model Canvas (BMC) is an instrument that may be used to develop, illustrate, and express a business idea. It does this by reflecting the idea in a canvas that can be simply designed to plan a creative business model. Osterwalder and Pigneur (2010) presented nine different building blocks of BMC that can be used to characterize a business model. These building blocks include key activities, key partners, key resources, cost structures, customer interactions, customer segments, value prepositions, channels, and income streams. Each section of the BMC has detailed explanations of all business-related concepts. The process of designing a business model by using BMC is iterative, and during the process of implementing the business model in the real world, changes may need to be made. BMC has been employed in a wide variety of research fields, such as the estimation of new product sales situations (Iskandar et al., 2022).

The establishment of profitable enterprises for industries (Joyce and Pacquin, 2016), the predicting of financing business models (Fallahi et al., 2022), and social enterprise modeling for the onion agro-industry (Pamungkas et al., 2018). To applying the institutional model to the procedure of providing support to self-sufficient smallholders in the real world, the current investigation made use of BMC to record all of the relationship elements that were present.

2.6 Limitation of the study

The Business Model Canvas (BMC) is a strategic management tool that allows businesses to develop, visualize, and describe their business models. However, like any tool or framework, it has its limitations. Here are some limitations of this study: The BMC can be too static and may not effectively capture the dynamic nature of businesses, especially in rapidly changing industries, and also may not capture all the nuances and intricacies of a business. Different respondents might interpret the elements of the BMC differently, leading to inconsistencies in how it is applied and understood. It relies on the assumptions and biases of the person or team creating it, which can lead to an incomplete or skewed representation of the business. This study may not fully incorporate external factors in terms of BMC analysis such as political, economic, social, technological changes, and environmental aspects.

By acknowledging these limitations, corporate farming businesses can use the BMC more effectively, understanding that it is one part of a larger toolkit needed for comprehensive business analysis and planning especially for independent palm oil smallholder farmers.

3 Results

3.1 Smallholder characteristic

The defining characteristic of independent farmers is their informality and their access to a mill. As there is limited government support for these self-taught smallholders and few private suppliers, smallholders must source seedlings, fertilizer and other inputs from informal networks, which are generally of inferior quality, leading to significant yield gaps with other producers. Central to the supply chains of independent smallholders in two district samples are small-scale traders that are responsible for transporting fresh fruit bunches to mills. Farmers are unable to sell directly to a mill without a delivery order license, meaning that they are dependent on license-holding traders through Informal and unwritten agreements. These traders can have dual functions of both providing credit and inputs to smallholders as well as transporting and purchasing fresh fruit bunches, which can lead to a monopsony that can reduce the price paid to farmers.

The characteristics of oil palm smallholders are the characteristics of farmers in believing, acting, and feeling, which include age, farming experience, and land size both in two districts sample has been employed by descriptive analysis. Knowing the characteristics of farmers is one of the pieces of information needed by producers to determine the right segmentation, target market, and positioning. The results of the study show that the average age of smallholders in Bengkulu Province is in the productive age category. In the productive age category, farmers have the potential to develop farming and increase production and income. Training for farmers can be carried out for young farmers to expand and increase their knowledge about correct oil palm cultivation techniques, including the use of quality seeds, so that with the increasing age of farmers, it is expected that maximum production will be achieved.

Experience is an important factor in working as a farmer. From this farming experience, farmers get various pieces of information from various parties to improve the oil palm cultivation system. Thus, the experience of farmers can improve the management system of oil palm plantations so that maximum production is obtained. Palm oil smallholders in two districts have a good average experience. This indicates that the smallholders never changed jobs as farmers. According to survey results, most farmers have 7–15 years of farming experience. Oil palm plantations have long been established, and most people rely on their existence as farmers due to the geography that supports Indonesia as an agricultural country. Furthermore, Land area is one of the most important factors agricultural productions because farming activities, including the type of commodity and farming patterns, are influenced by the land area managed by farmers. The land area affects the income derived by farmers from their farming activities. The research findings indicate that most farmers have land areas of less than 3 ha.

3.2 Identification and mapping the elements of business model canvas

The first thing that needed to be done was to conduct an analysis of the existing business models in order to have an understanding of the commercial practices of the farmers and purchasers that were the focus of this study. To accomplish this goal, an analysis of previously conducted value chain studies as well as evaluations of the local market were carried out. In addition, surveys were conducted on both the buyers and producers in order to gain further insight into the dynamics of the local business environment.

One of the sources of raw materials that are available on the upstream side of the crude palm oil (CPO) trade system is fresh fruit bunches (FFB), which are produced by oil palm smallholders who are independent of one another. The use of CPO as a raw material for cooking oil presents an opportunity for independent oil palm planters to participate as CPO supply chain actors in a sustainable cooking oil trading scheme. This opportunity arises as a result of the utilization of CPO as a raw material for cooking oil. We describe the business model of using FFB of oil palm smallholders as CPO raw material in a corporate scheme and collaboration with the industry through farmers cooperating using the analysis technique known as the Business Model Canvas. We identified nine (nine) main features in the business model canvas in order to map the business model canvas of independent oil palm farmers in the Konawe and South Konawe districts of Southeast Sulawesi. This was done so that we could map the business model canvas of these farmers. The business model canvas for the independent oil palm plantation was developed using the findings of the FGDs that were conducted with stakeholders in the area surrounding the plantation. The independent oil palm plantation's first business model canvas is as follows, and it is comprised of the following elements:

3.2.1 Customer segments

Producing fresh fruit bunches, also known as FFB, is the primary means by which independent smallholders make their living. Customers include FFB suppliers that come from independent smallholders as well as FFB purchasers that come from palm oil mills (PKS). Because farmers produce oil palm plants from non-inferior oil palm seeds and the maintenance procedure is not optimal, FFB suppliers are given special attention. This is because farmers grow oil palm plants from non-inferior oil palm seeds. Further, FFB buying customers are a priority, which means that they are required to be consistent, promptly and agree on the quality standardization of FFB products. Materials must be supplied. Customers who are also independent oil palm farmers socialize with and provide advice to other oil palm farmers concerning FFB. In the meantime, customers of PKS are required to offer FFB of a high quality, and the maximum amount of time between harvesting and delivery of FFB is 24 h.

3.2.2 Value proportion

Profitability, simplicity, and effective communication are manifestations of the value contributed to consumers (Value Proportion) that other independent smallholders provide to FFB providers. This value is delivered by independent smallholders. While this is going on, independent smallholders are providing FFB buyers with quality, quantity, and continuity. In order to ensure a continuous flow of FFB into palm oil mills, it is possible for groups or independent palm oil smallholders to form cooperatives in order to meet the requirements of FFB suppliers.

3.2.3 Channels

These are the various avenues through which one can communicate with one's clients. Communication, distribution, and sales networks provide independent palm oil cooperatives and farmers with avenues via which they can interact with their respective consumer bases. Independent groups and farmers provide a platform for farmer cooperatives in the form of independent palm oil farmer cooperatives so that farmer groups can connect with clients, particularly FFB purchasers. Communication occurs both directly and indirectly, through middlemen provided by distributors.

3.2.4 Customer relationship

Establishing and maintaining positive relationships with consumers is one of the most critical steps that businesses can do to keep existing clients. In an effort to build positive ties with customers, independent palm oil groups and farmers, the Palm Kernel Society (PKS) has been working to fortify the connections between palm oil farmers serving as FFB suppliers and FFB purchasers. The pattern of relationship that the group and independent oil palm growers have

established with CPO purchasers and FFB suppliers is highly successful.

3.2.5 Revenue streams

The income that a firm receives from a certain market sector are referred to as the company's "revenue streams." The selling of FFB is the primary source of income for oil palm farmer cooperatives and independent organizations. The mechanism that the company uses to determine the purchase price of FFB is based on the price determination price and K index of Southeast Sulawesi Province, which are applied on a monthly basis. This index is used by the province.

3.2.6 Key resources

The term "key resources" refers to those assets that an independent oil palm organization or farmer needs in order for their business capital to function properly. These resources make it possible for a group of oil palm farmers or an independent oil palm farmer to create and provide value propositions, acquire markets, monitor connections with market segments, and generate income. Independent smallholders in Southeast Sulawesi use key resources such as physical resources (physical assets owned by the group/independent smallholders), financial resources (personal money of independent smallholders), and human resources (competent labor) in their oil palm business model.

3.2.7 Key activities

The provision of adequate added value necessitates those certain actions, referred to as key activities, be carried out by the organization or the business group in concern. Every type of company has core operations, such as the production of FFB, which includes everything from planting oil palms to manufacturing FFB.

3.2.8 Key partnership

Farmer cooperatives and individual oil palm farmers often work together to develop partnerships for their commercial endeavors. The objective of the partnerships that were established by the organizations and individual oil palm growers was to optimize the operations of the businesses so that they could function in an effective and efficient manner. Connections with FFB suppliers, or other independent oil palm farmers, as well as interactions with FFB buyers at the nearest PKS in each region are the two forms of partnerships that can be developed by groups and independent oil palm farmers. Both types of partnerships are instances of such partnerships. This agreement is being formed to ensure that the PKS will have access to the necessary raw materials to continue operating its operations. When it comes to the cultivation of oil palm, partnerships with other independent oil palm farmers are formed depending on the compatibility of the type of oil palm that is grown as well as the kinship of the oil palm farmers.

3.2.9 Cost structure

Independent oil palm farmer groups, like other companies, attempt to apply financing in as effective a manner as is possible to cut costs that are incurred in order to acquire a good profit margin. This is done to ensure that the profit earned can reach its maximum value. Independent smallholder groups in Southeast Sulawesi are not overly concerned with the costs that may occur in the process of designing a business model. Instead, they are more focused on value creation, which is why they are referred to as value driven. Their company incurs various costs, including fixed costs, production costs, operational costs, and promotional costs as a result of doing business. The largest costs are those associated with the daily labor costs in the oil palm plantation as well as the maintenance of the oil palms. Following the mapping of the nine components of the business model utilized by the present-day autonomous oil palm smallholder group, a business model canvas was created. This is done so that the nine aspects of the business model, as well as the relationship that exists between each element, may be visualized more easily. Table 1 provides a visual representation of the mapping of the current business model utilized by the independent smallholder group.

In the current model, most independent smallholdings are developing around industrial and plasma plantations. These smallholders sell their harvest to middlemen, who then bring it to the oil mill to be processed. The middlemen are crucial participants in this market as they are responsible for the collection of FFB from many smallholders and then negotiating the price with the mills. Compared to estate plantations and plasma plantations, the productivity of oil palm independent smallholdings is significantly lower. Farmers do not have access to seedlings of profitable kinds, and they lack knowledge in the best techniques on fertilization or pest management (Good Agriculture techniques). Good Agriculture Practices refers to the best methods for fertilization and pest management. However, they are gaining knowledge by consulting the laborers who work on the plantations and engaging those individuals as either daily laborers or plantation managers. According to Rist et al. (2010) independent smallholders can make a profit from oil palm plantations, particularly when compared to the profits made by other smallholders' plantations.

Local small-scale producers in the Konawe and South Konawe Districts are members of a cooperative that offers support on agricultural techniques but plays only a minor role in marketing produce. These cooperative offers support on farming techniques. Buyers interact with smallholders on an *ad hoc* basis and receive minimal support to strengthen their own business capacities and purchasing processes to enable smallholder procurement. This makes it difficult for buyers to source products from smallholders. Most transactions are conducted one-on-one between buyers and sellers. Milling to produce palm oil can be broken down into two categories: industrial and traditional. The conventional method is straightforward, but it does not maximize oil extraction or nutritional value. The more basic the method, the less efficient it is, and the fewer nutrients it yields. Two distinct value chains can be distinguished within the smallholder-based palm oil industry: the FFB value chain, in which farmers process the bunches at small processing mills in order to produce CPO, which is then sold to traders and wholesalers for retail at rural and urban markets; and the CPO value chain, in which FFB is produced and sold directly to industrial millers in order to facilitate large-scale processing.

3.3 Upgraded business model

Independent oil palm smallholder groups are concentrating their efforts on the creation and development of an upgraded business model with the goal of giving new value to increase the quality of products or commodities produced and maintain strong relationships

TABLE 1 Identification and existing business model mapping of independent oil palm smallholder groups in Southeast Sulawesi.

<table>
<tr><th>Key partners</th><th>Key activities</th><th>Value propositions</th><th>Customer relationship</th><th>Customer segments</th></tr>
<tr><td rowspan="3">– Independent Oil Palm Farmers farmer groups
– Oil Palm Farming Groups/ Cooperatives
– Crude Palm Oil (CPO) Processing Mills
– Middlemen
– Government Agencies at the local level
– Association of Independent farmers (APKASINDO)</td><td>– Plant cultivation [not in Good Agriculture Practices (GAP)]
– Oil Palm FFB Production (Raw Material)
– FFB Sales</td><td rowspan="2">– Low Productivity due to low quality of seed, lack of GAP, and lack of srop management.
– Low price of FFB due to low quality of FFB and no bargaining position</td><td>– No partnership with oil palm mills
– No access to bank
– No partnership with APKASINDO
– Low coordination with local agencies
– Lack of coordination between farmers group and partners</td><td rowspan="3">– Individual oil palm farmers
– Farmers group</td></tr>
<tr><td>Key resources</td><td>Channels</td></tr>
<tr><td>– Financial Capital Individuals and Farming Groups/
– Cooperatives
– Investment: Plantation land, buildings, production equipment, and raw materials.
– Family Farming</td><td></td><td>– Middle-Men
– Oil palm mills</td></tr>
<tr><td colspan="2">Cost structure</td><td colspan="3">Revenue streams</td></tr>
<tr><td colspan="2">– Production cost
– Lack of Financial Management
– Cash crop</td><td colspan="3">– Fruit Fresh Bunchies (FFB)</td></tr>
</table>

10.3389/fsufs.2024.1418732

with consumers. These conditions are derived from the findings of the FGD analysis. In accordance with the assertion that adjustments in one element will be associated with changes in other elements that will be supported by changes in other elements made by Osterwalder and Pigneur (2010). An explanation of how changes in one element effect other elements is provided in the following paragraphs, specifically:

a. Value needs to be contributed to client relationships by autonomous smallholder groups in the shape of high-quality FFB goods.
b. Independent smallholder groups need to improve the quality and efficiency of critical operations, particularly production activities, in order achieve this value.
c. It is required to use quality oil palm seeds, develop more effective cultivation and processing technologies, and in an effort to increase both the efficacy and quality of production processes, it is necessary to utilize better oil palm seeds. This can be accomplished through the utilization of various opportunities provided by cooperation partners, such as BPDPKS and other businesses.
d. Improving customer relationship performance in the form of an increase in the level of consumer loyalty to products made by independent oil palm smallholder group may be accomplished by optimizing the quality value of products and developing new products in a manner that is congruent with the wishes of customers.
e. The rise in the running of partnerships, with this new value necessitating greater resources in the form of additional plantation land as well as additional human resources.
f. As a consequence of the increase in value, self-sufficient smallholder groups will be required to pay more expenses. These expenses will include costs associated with the production of FFB as well as costs associated with the processing and maintenance of oil palms.
g. As a result of taking advantage of this value, the group of independent smallholders can generate new sources of revenue streams and to have diversified income streams.

Because of the revised value proposition that was presented earlier, various components of the business model canvas, including Key Activities, Key Resources, Key Partnerships, Customer Relationships, Cost Structure, and Revenue Streams, have been modified or have been given new information. Graph 2 depicts the incorporation of different business models into the business model canvas that was previously established.

In the following table, it is explained that in order to further enhance the institutional business model of independent oil palm smallholder groups, it is important to gain knowledge about business development in farmer groups through the establishment of oil palm cooperatives consisting of non-plasma independent oil palm smallholders based on the principle of partnership. This is equivalent to the development of a mini-CPO processing plant with a scale of 2 to 3 tons per hour of FFB. APKASINDO and BPDPKS are obligated to provide support for the development of oil palm cooperatives in the upstream supply chain system. This support can come in the form of replanting, intensification, and extensification programs, as well as other facilities and infrastructure assistance, such as mini-CPO mills. Additionally, cooperative offices and banks can serve as local partners who can provide access to assistance. It is anticipated that inclusive partnerships established through palm oil cooperatives will result in a greater proportion of value with improved GAP, increased FFB production, improved FFB quality, improved FFB prices, long-term cooperation contracts with cooperatives, and the processing of CPO waste as an added value to increase the income of oil palm farmers. As a result, customer segmentation can be broadened based on the primary products of CPO and cooking oil, as well as market segments for the results of processing waste with economic value, such as liquid and solid organic fertilizers, animal feed, and biofuels. Additionally, customer segmentation can be based on market segments for the results of processing waste with economic value (Table 2).

3.4 Corporate farming model of independent palm oil smallholder

More than 3.1 million hectares of Indonesia's total palm oil plantations are owned by independent smallholders. However, talks regarding sustainability measures, deforestation, and palm oil production pay insufficient attention to them. In the meantime, there is evidence that suggests that farmers have opportunities to access productive assets for expanding their capacities, for seizing economic changes, and for policy making if they collaborate voluntarily in organizations and build linkages with public and private stakeholders among institutional arrangements (Nurliza, 2020). These findings were published in the journal Nutrition Research and Practice. Therefore, corporate farming as a business model has been created by this study in order to maintain the FFB supply chain of CPO over the long term based on a partnership that is inclusively carried out through cooperative independent oil palm smallholders (Figure 1).

The creation of a business model based on corporate farming through oil palm smallholder cooperatives can be seen as the entire system of flow of goods or products when examined from both the upstream and downstream sides, as shown in the picture below. This can be described further by looking at the graph. To begin, we'll start from the side that faces upstream. The primary concern is the long-term availability of FFB, which is directly correlated to the quantity and quality of FFB that is generated by self-sufficient smallholder farmers. Good agricultural practices are the foundation for increasing FFB output while simultaneously enhancing its quality. These practices include the use of certified superior seeds, plant cultivation, the availability of fertilizers, as well as supporting facilities and infrastructure. Therefore, APKASINDO and BPDPKS, along with local governments in particular, become true partners for independent palm oil farmers by implementing replanting, intensification, and extensification programs, in addition to providing assistance with other facilities and infrastructure, such as superior seeds, fertilizers, and pesticides, as well as training and guidance for independent palm oil farmers. Additionally, individual farmers, farmer groups, and farmer group associations can all become members of an oil palm farmer cooperative. According to the findings of the surveys conducted in both Konawe and South Konawe, an oil palm cooperative has been established; however, the lack of a partnership structure that is more all-encompassing has prevented the cooperative from being able to grow its business unit.

As a result, in the model of corporate farming, the palm oil cooperative is able to build its business unit as FFB off taker by means of a contract arrangement that is mutually agreed upon by both

TABLE 2 Business model upgraded of independent oil palm smallholder.

<table>
<tr><th colspan="4">Canvas business model in the institution of oil palm smallholder</th></tr>
<tr><th>Key activities</th><th>Key partners</th><th>Proportion of value</th><th>Customer segmentation</th></tr>
<tr><td rowspan="3">1. Business lesson as managerial functions in the integrated institutional business
2. Become the member of cooperatives as the partner that connects the raw material provider actors (Gapoktan/Independent Smallholders) with palm oil processing cooperative through long-term partnership contracts
3. Establish partnership program and contracts with financial institutions related to the provision of venture capital and distribute it to members (GApoktan/independent smallholders)
4. Provide recommendations to the Plantation Office in the context of providing subsidies from the national oil palm fund in the replanting program/ or intensification program (fertilizer, seed and pesticide)</td><td>1. Cooperative of oil palm farmers
2. Funding Institutions (Banks or other funding agencies)
3. Government agencies at the local level (Plantation Office, Department of Cooperatives)
4. Association of independent smallholders (APKASINDO)</td><td rowspan="3">1. Improving Good Agriculture Practices (GAP)
2. High bargaining market for FFB price through inclusive CPO supply chain
3. Improving knowledge of high seed quality
4. Long term contract of FFB supply chain through partnership program with cooperative
5. Improving the quality and productivity FFB
6. Waste management of CPO process</td><td>1. Cooperative
2. Cooking oil market
3. Organic fertilizer consumers</td></tr>
<tr><td>Key Resources</td><td>Channel</td></tr>
<tr><td>1. Trusted role models
2. Transparent and accountable managerial system
3. Availability of budget and financial support for institutional needs</td><td>1. Cooperative
2. Cooking oil industry
3. Banks
4. BPDPKS
5. APKASINDO</td></tr>
<tr><td colspan="2">Benefits</td><td colspan="2">Obstacle factor</td></tr>
<tr><td colspan="2">1. Cooperative members organization that is able to increase the income of independent smallholders as the guarantee of long terms contract of FFB supply chain inclusively.
2. Involving APKASINDO and BPDPKS program to improve the productivity and quality of FFB
3. Increasing FFB price through simple supply chain in the cooperative
4. Value added of secondary product of CPO waste management</td><td colspan="2">1. Policy conflicts between government agencies
2. Strong influence / role of 'collectors' in the oil palm supply chain
3. Conflict interest of management in cooperative organizations
4. Limited capacity of institutions that play role in the process of fostering independent palm oil farmers</td></tr>
</table>

parties. Furthermore, the development of palm oil cooperatives as a business unit through off takers must develop partnerships with the cooperative and MSME offices at the regional level in order to improve the function and management of cooperative organizations. Additionally, banks and other financing institutions must provide capital in order to develop broader business units by developing mini-CPO processing plants on a scale of 2 or 3 tons of FFB per hour. This can be done by developing mini-CPO processing plants on a scale of 2 or 3 tons of FFB per hour.

By this model, the small CPO mill has a larger market segment on the downstream side since apart from producing CPO, it can also produce cooking oil and other products that have economic value as added value from processing FFB waste and CPO waste. These products include liquid and solid organic fertilizer, animal feed, biofuel, and fuel from empty bunches and palm kernel shells. Therefore, the model of corporate farming could be an option for the implementation of a policy that would promote the welfare of farmers. In addition, it is anticipated that this model will shorten the lengthy supply chain, which has historically been harmful to smallholders, ultimately leading to an improvement in the welfare of autonomous smallholders.

3.5 CPO supply chain sustainability of corporate farming for smallholder farmers in the long-term aspects

Cooperative farming can be a powerful approach to achieving sustainability in the production of crude palm oil (CPO). Cooperatives allow smallholder farmers to pool resources, share knowledge, and improve their market access, all of which can contribute to more sustainable and profitable farming practices. To achieve a sustainable and equitable palm oil industry, it is essential to find a balance between the efficiency and scale of corporate farming and the empowerment and inclusion of smallholder farmers. Collaborative efforts between governments, private sector, bank institutions, BPDPKS, APKASINDO and smallholder communities can foster a more sustainable and inclusive palm oil sector. These partnerships will also help cooperatives navigate certification processes and implement sustainable practice. Furthermore, by banding together, smallholder farmers can share expensive resources such as machinery, processing facilities, and transportation. Cooperatives

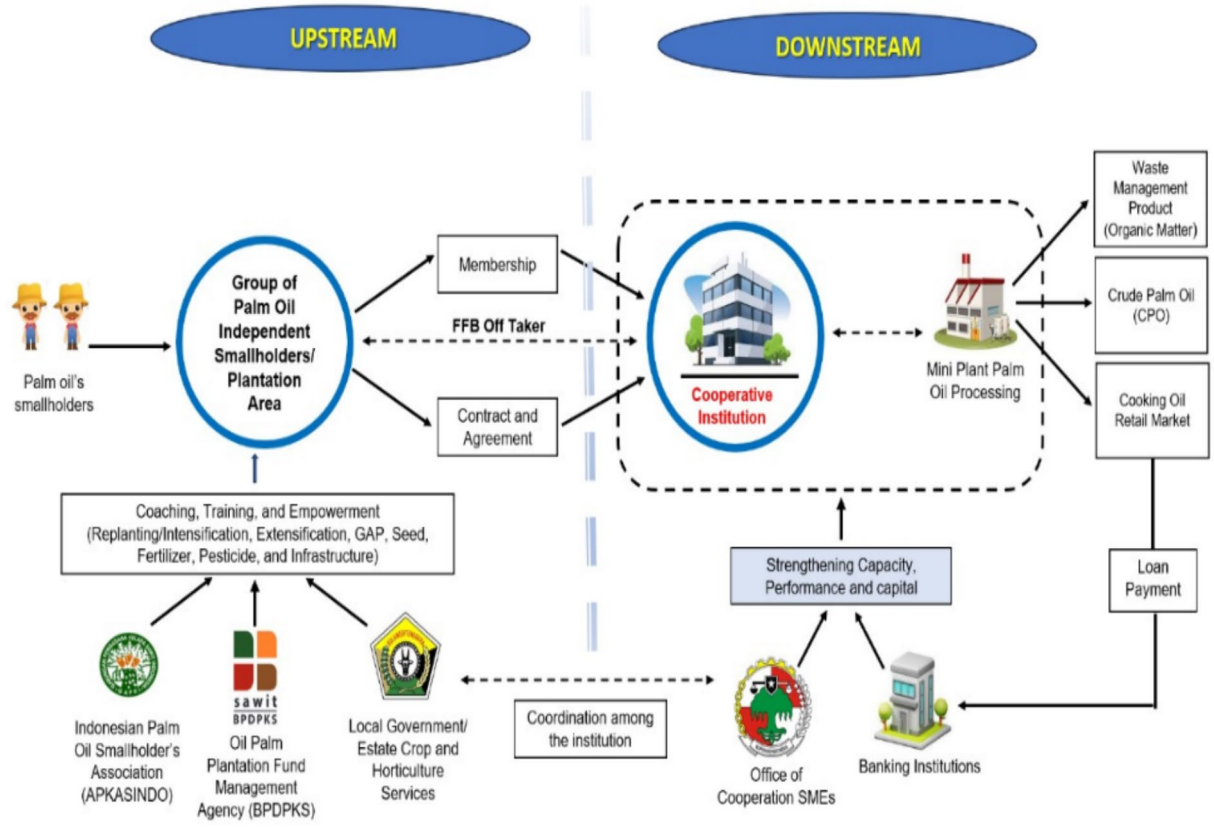

FIGURE 1
Corporate farming model for sustainable CPO supply chain of independent smallholder farmers.

can leverage collective bargaining to purchase inputs like fertilizers and pesticides at lower costs.

BPDPKS and Government should offer the Programs through the cooperatives that provide training on sustainable agricultural practices, financial literacy, and business management which help smallholders improve productivity and sustainability. Microfinance initiatives, grants, and cooperative models help smallholders with the financial resources needed to invest in their farms. Initiatives that connect smallholders with larger markets, such as private sector, fair trade organizations, and certification schemes (e.g., ISPO and RSPO) will ensure fair prices and better market access. Achieved ISPO-RSPO certification, ensures that their palm oil is produced sustainably and meets international standards. This certification can open new markets and command higher prices. Fair Trade certification ensures that smallholder farmers through cooperative in the corporate farming model receive fair prices and that their working conditions meet specific standards, and with Fair Trade certification will attract consumers willing to pay a premium for ethically produced palm oil. Corporate farming through cooperative must navigate complex market dynamics and competition. Building strong relationships with buyers, private sector, bank, APKASINDO, BPDPKS, government and exploring niche markets for sustainably produced CPO ensure long term market stability.

Corporate farming through cooperative offers a promising pathway for smallholder farmers to achieve sustainable CPO production. By pooling resources, sharing knowledge, and improving market access, cooperatives can enhance productivity, sustainability, and profitability for their members. Support from various stakeholders, including governments, private sector, bank, BPDPKS, and APKASINDI, is essential to overcoming challenges and ensuring the long-term success of cooperative farming in the palm oil industry in Indonesia. Thus, comprehensive risk management strategies are essential for the sustainability of corporate farming in this context (Imbiri et al., 2023).

4 Conclusion

Building up the institutional capacity of oil palm smallholders through the formation of oil palm cooperatives results in increased economic power for oil palm smallholders, which in turn improves the welfare of independent oil palm smallholders. It is possible to disrupt the lengthy supply chain and the uncertainty of FFB (Fresh Fruit Bunch) prices at the farm level through a consortium of oil palm cooperatives that serve as off takers. This would also boost the revenue streams of independent oil palm farmers.

The emergence of corporate farming, specifically through oil palm cooperatives, has facilitated the provision of capital assistance, technology, and necessary infrastructure to independent smallholders involved in oil palm cultivation. This support is made possible through collaborative efforts with various entities such as APKASINDO, BPDPKS, the Ministry of Cooperatives and Micro, Small, and

Medium Enterprises (MSMEs), the Ministry of Agriculture, as well as banks and other financing institutions. The primary objective of these partnerships is to enable smallholders to engage in replanting/intensification, extensification, and infrastructure initiatives.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was required for the study on human participants in accordance with the institutional requirements. Written informed consent from the participants was required to participate in this study in accordance with the national legislation and the institutional requirements of Ethics Committee of Social Humanities Department of Indonesia National Research and Innovation Agency (BRIN) number 351/KE.01/SK/06/2023. The studies involving human participants were reviewed and approved by Dr. Augustina Situmorang, M.A. The patients/participants provided their written informed consent to participate in this study.

Author contributions

JW: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing – original draft, Writing – review & editing. DD: Conceptualization, Investigation, Writing – review & editing. SF: Conceptualization, Investigation, Project administration, Resources, Supervision, Validation, Writing – review & editing. AY: Formal analysis, Writing – review & editing. AF: Formal analysis, Supervision, Validation, Writing – review & editing. Muslimin: Supervision, Validation, Writing – review & editing. RS: Supervision, Validation, Writing – review & editing. DA: Supervision, Validation, Writing – review & editing. Imran: Supervision, Validation, Writing – review & editing. RP: Supervision, Validation, Writing – review & editing. NS: Conceptualization, Data curation, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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