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Challenges in the development of cooperative-based closed-loop refined palm oil agribusiness in Indonesia

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ABSTRACT
There are marginal issues faced by independent palm oil farmers at the farm gate level and distortions in the downstream market, prompting the Ministry of Cooperatives and Small and Medium-sized Enterprises (SMEs) of Indonesia, the Palm Oil Fund Management Agency, and PTPN Group to pilot a program for downstreaming independent oil palms through cooperatives. The refined palm oil (RPO) program processes crude palm oil (CPO) using fractionation and soft refining without bleaching and deodorization. Its goal is to stabilize fresh fruit bunch (FFB) prices and provide affordable cooking oil alternatives. The government supports this initiative through regulations, constructing RPO plants, and allocating them to cooperatives.This study seeks to assess the planning, closed-loop RPO agribusiness development, and requisite strategies for its success. Using methods like Context, Input, Process, and Product (CIPP) and Analytical Hierarchy Process (AHP) for qualitative research shows that for the program to work at its best, separate palm oil crops must be used to match the capacities of RPO plants. Furthermore, government subsidies are crucial because of the elevated manufacturing costs of RPO relative to CPO. Moreover, continuous branding initiatives by the government and cooperatives are essential to improve public acceptance and commercial visibility. Some of the strategies that could be used to support the success of the program include building and granting oil palm processing (OPP) plants to cooperate for independence; certification of Roundtable on Sustainable Palm Oil (RSPO) on all independent palm oil plantations; and application of more efficient processing technology technically and economically so that the product could compete with other commercial palm oil products.

Contribution/Originality: This research examines a cooperative-based model to support independent palm oil farmers in Indonesia, focusing on fair market access and downstream processing. It looks at a government pilot program and suggests ways to make the palm oil sector more sustainable and competitive in the market, such as cooperatively owned processing plants and RSPO certification.

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1. INTRODUCTION

There are two big problems in Indonesia's palm oil industry: independent farmers are being pushed to the edges of the upstream sector, and the downstream cooking oil market is very concentrated and oligopolistic, with vertical integration. These issues have resulted in limited bargaining power for small-scale farmers, who remain essential contributors to the national palm oil supply chain. Palm oil agribusiness plays a crucial role in Indonesia's rural economy, where independent farmers predominantly operate small-scale businesses with low market influence (Bissonnette, 2016). Recognizing these issues, the Commission for the Supervision of Business Competition in Indonesia has recommended that the government ensure the steady availability of cooking oil across the supply chain, preventing palm oil from becoming a "resource curse" (Sogen, 2023).

In response, the Ministry of Cooperatives and SMEs, alongside the Palm Oil Fund Management Agency (POFMA) and the PTPN Group, has launched a cooperative-based model for refined palm oil (RPO) production. This initiative aims to enhance farmers' bargaining positions, address domestic cooking oil demands, and promote an "outward-looking industry" strategy (Rahayu, Nugroho, & Yusuf, 2022). The cooperative-based RPO agribusiness model functions as a closed-loop system, integrating independent farmers through cooperatives that act as aggregators, processors, and marketers. This model, facilitated by POFMA funding and technological support from PTPN Group, provides independent farmers with a market guarantee and enables them to process fresh fruit bunches (FFB) into crude palm oil (CPO) in a sustainable and organized manner.

However, several challenges hinder the successful development of this cooperative-based RPO agribusiness model. These include: (1) RPO production via fractionation and soft refining, which lacks the extensive processing steps of premium palm oil; (2) concerns regarding the quality and sustainability of FFB sourced from cooperatives, as opposed to large-scale plantations; (3) the significant capital required to adhere to closed-loop principles; (4) the public's uncertain acceptance of RPO; (5) higher production costs relative to CPO, necessitating competitive pricing to remain viable against bulk cooking oils; and (6) the preparedness of cooperatives and PTPN as partners in the CPO processing chain.

Even though cooperative-based RPO agribusiness has the potential to give independent farmers more power and keep the cooking oil market stable, not much research has been done on the operational and strategic problems that come up when trying to make this model bigger. Specifically, there is a lack of empirical insights into effective strategies for enhancing product quality, achieving economic viability, and fostering public acceptance. This study fills this gap by examining the planned approaches and strategies necessary for the successful implementation of cooperative-based RPO agribusiness in Indonesia. Through a mix of qualitative and analytical hierarchy methods (CIPP and AHP), the research aims to look at the closed-loop RPO development process, pinpoint key success factors, and make suggestions for how independent farmers can compete in the larger palm oil market.

2. RESEARCH METHODOLOGY

This study was conducted from March to May 2024 in the operational area of the RPO plant, which will be allocated by the government to the Pujakesuma Cooperative in the Pagar Merbau subdistrict, Deli Serdang Regency, North Sumatra. The Indonesian president inaugurated this as the sole cooperative-based RPO facility operating in Indonesia. The gathered data comprised both primary and secondary sources. Primary data were acquired through in-depth interviews, observations, focus group discussions (FGD), and closed-ended questionnaires. Secondary data were acquired through desk and documentation investigations from multiple sources published by pertinent agencies.

The Context, Input, Process, and Product (CIPP) model (Stufflebeam, 1983) served as the assessment instrument. This evaluation method is thought to be right for this study because it fits with the product development framework and gives a good picture of how the program or activity was carried out, from planning to meeting goals. The Analytical Hierarchy Process (AHP) was subsequently employed to establish the prioritization of growth plans (Saaty, 1990). Setting up a hierarchy of elements, such as selection criteria and options, comparing these criteria and options pairwise, figuring out priorities by looking at how all the options rank, and checking for logical consistency are all parts of the process. The participants in the AHP analysis were the institutions involved in the closed-loop program. Data were analyzed with Super Decisions software V2.8, with respondents' opinions considered consistent if the inconsistency value was below 0.1. The highest score found in the data analysis at both the factor and strategy levels led to the conclusion that the mitigation strategies should be put in order of importance. The conclusion for establishing the priorities of the mitigation strategies was derived from the highest score obtained from the analyzed data at both the factor and strategy levels. Hierarchy was established by defining objectives, identifying the criteria for evaluation, and formulating the tactics to be executed. The identification of issues and measures for mitigation was founded on the Regulation governing the Management of Cooperative-based RPO.

3. RESULTS AND DISCUSSION

3.1. Management of Cooperative-Based RPO

According to Presidential Regulation No. 61 of 2015 on the Organization and Use of Palm Oil Plantation Funds, one of the purposes of the funds is for the downstream industry (Nasution, Handayani, Bagio, Agustiar, & Sufriadi, 2022). One way to improve the independence of farmers is to develop a cooperative RPO plant. RPO is obtained through refining (fractionation and soft refinery), without bleaching and deodorization from CPO, and can be used as cooking oil, raw materials for food, food additives, consumed directly as additional intake of nutrition, or palm cooking oil fortificants and raw materials for nutraceuticals (Purnama, Setyaningsih, Hambali, & Taniwiryono, 2020).

The management of RPO follows the development of the RPO plant, funding by POFMA, and plant management by cooperation, guidance, and supervision (Setiajiati, Nurrochmat, Van Assen, & Purwawangsa, 2024). The government is planning to build three RPO plants in Sumatera Utara: in the Pagar Merbau subdistrict, Deli Serdang Regency, Tualang Subdistrict, Langkat Regency, and Pulau Rakyat subdistrict, Asahan Regency. The POFMA funding enabled

the construction of the cooperative-based RPO plants, at an approximate cost of 15 billion Indonesian rupiah. The plant with a daily capacity of 10 tons is to be granted to a cooperative that has fulfilled the criteria in accordance with the regulations and is managed under the supervision of the Ministry of Cooperatives and SMEs of Indonesia and PTPN Group (PTPN III and Indonesian Oil Palm Research Institute). There are three production models for cooperative-based RPO production: independent, toll processing, and CPO purchase (Kusumadewi et al., 2024). As part of the independent model, a cooperative was in charge of getting Fresh Fruit Bunches (FFB), processing them into CPO and then RPO, distributing and selling the goods. This is called closed-loop agribusiness.

The toll-processing model is similar to that of the first independent model. However, third parties perform the conversion of FFB into CPO. There is a dependency on outsourcing; thus, it does not meet the requirements of closed-loop principles. The CPO purchase model procures raw materials from external sources. This model does not meet the closed-loop principles and thus cannot be adopted because it does not fit the concept of improving the welfare of oil palm farmers. The independent model is the most ideal model to meet the closed-loop RPO agribusiness principles, as all the activities involved from farm gate to downstream are performed from, by, and for cooperatives. Figure 1 illustrates the details of managing a cooperative-based RPO.

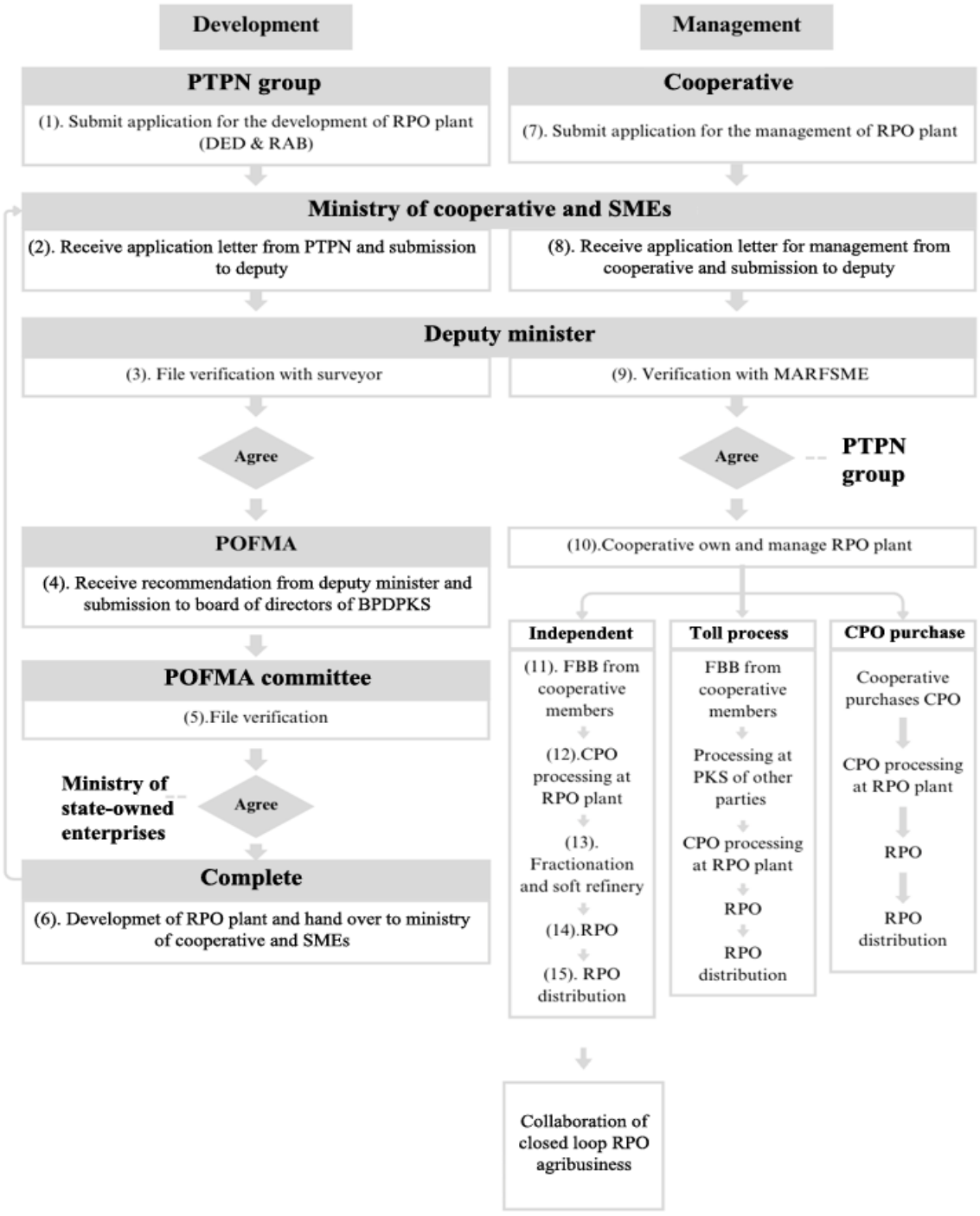

Figure 1. Management of cooperative-based RPO.

3.2. Cooperative as Cooking Oil Agribusiness Subject

A cooperative is a business entity comprising people or legal entities whose activities are based on the principle of togetherness as well as an economic movement based on the nature of kinship (Budi, 2022). In the management of RPO plants, cooperatives should provide human resources, raw materials, technology, product standardization, and marketing strategies. The managing cooperative that received the grant operates in the plantation sector, with independent oil palm farmers as its members. A cooperative is required to meet the daily production of 50 – 60 tons of FFB to ensure the sustainability of the raw materials. The cooperative should have a minimum of 1000 hectares of palm oil plantations to meet the mean productivity of 1800 kg FFB monthly. Cooperative members supplied all materials, and the cooperative, acting as an aggregator, supervised the quality.

The cooperative created a memorandum of understanding on the use or utilization of PTPN III and its subsidiaries within an area of at least 5000 m2 for a period of use of at least 30 years on the plant location. The cooperative also needs to prepare a maintenance budget in the form of utilities and other variable costs that meet the installed production capacity. Revolving funds from the Managing Agency of Revolving Fund for Small and Medium Enterprises (MARFSME) can be used for expenses, as the regulation states that the government only provides grants in the form of RPO processing plants (Mafira, Mecca, & Muluk, 2020). The RPO plant in Merbau subdistrict, Deli Serdang, is planned to be managed and granted to the Pujakesuma Cooperative under the supervision of the Ministry of Cooperative and SMEs. This cooperative is engaged in the field of oil palm and was founded on March 23, 2020. It consisted of independent oil palm farmers who fulfilled the permits and requirements to obtain grants and management rights from the ministry.

The characteristics of cooperatives, including land information, production, productivity, and socioeconomic characteristics, are presented in Table 1. It can be concluded that the age and productivity of crops owned by independent farmers are sufficient to support the installed capacity of the granted RPO plant. It is hoped that collection and transportation to the processing site can run effectively and efficiently, as the distance between farmers and the processing site is not relatively large. This condition is favorable so that FFB can quickly reach the plant with no or limited physical damage.

Table 1. Cooperative and members characteristics.

General characteristics (N=511)	Description
Address	Hamlet VI, Pagar Merbau II Village
Certificate of residence	No.780/2007/IX/2022
Endorsement from law and human rights ministerial decree	No.AHU-0001507.AH.01.38. Year 2022
Business license number (BLN)	9.12E+12
Average harvest area of palm oil (Ha)	2.14±1,10
Total harvest area (Ha)	921±215
Average crop age (Years)	8±6.2
- >3 to 10 years	433.2 (677)
->10 years	567.2 (347)
Average daily production (Tonnes)	45±19.0
Distance between farmers (km)	
Socioeconomic characteristics of cooperative member	4.5±1.2
Age (Years)	
-Male	42 ± 14.0
-Female	35.1 ± 12.3
Level of education (Above high school)	
-Male	211 (22%)
-Female	123 (25%)
Number of children (>3)	352 (69%)
Number of dependants (>3)	367 (72%)

3.3. Achievement of the Development of Cooperative-based RPO

The context, Input, Process, and Product (CIPP) evaluation model can describe the result of an activity from planning to the results obtained. This is related to the goals to be achieved, plan to be implemented, actions, and outcomes. Stufflebeam (2015) portrayed the core values of the CIPP model in Figure 2.

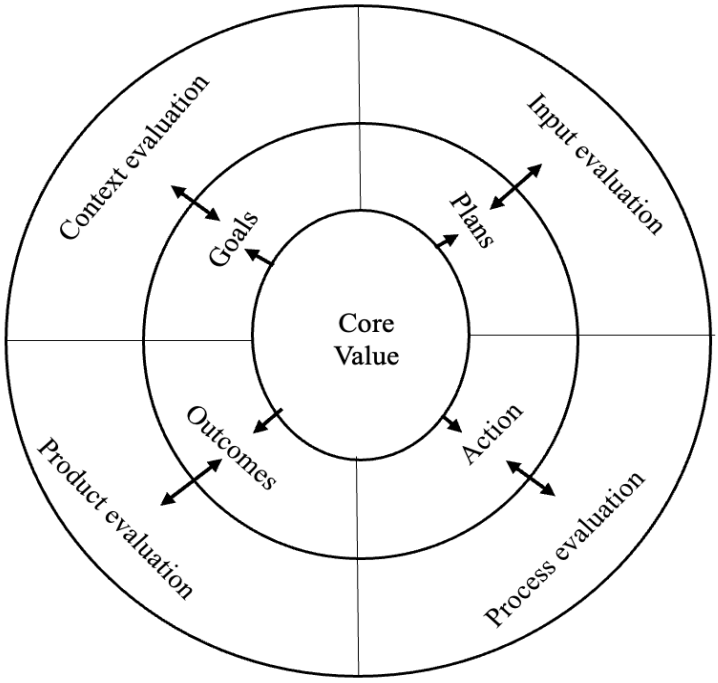

Figure 2. Core value of CIPP evaluation model.

The inauguration of RPO plant development as a pilot program for downstream oil palm through cooperation was done on March 14, 2024, by the Indonesian president, Joko Widodo, which only differs a week from the issuance of the Ministry of Cooperative and SMEs Regulations of Indonesia No.5 2023 and March 7, 2024. It can be concluded that all administrative processes have been completed before the regulations are promulgated and have been acknowledged as a whole process. In addition, the development of RPO plants, including the costs incurred before the regulations were promulgated, has been recognized as part of the process of development.

The development of the 15 billion-rupiah RPO plant in Pagar Merbau village, Pagar Merbau district, is funded by the POFMA. In Pujakesuma Cooperative will manage its 10 tons of daily RPO capacity independently. The PTPN Group owns the land where it is located, which is adjacent to their oil palm processing (OPP) plant. The processing technology and raw materials, FFB and CPO, were provided by Indonesian Oil Palm Research Institute. During this study, the toll processing model was still used, where the cooperative toll processes the FFB to PTPN Group to be processed to CPO, as the cooperative does not yet have the capability.

The main issue in this model is the yield level, as each party will have its own reasoning regarding the amount. The cooperative is expected to obtain a high yield level, while the other party will have their own refusal to refuse it. This is because the FFBs from cooperative members came from crops that might not have been precisely managed, unlike the PTPN Group. The large yield margin expected and claimed by the processor will certainly affect the cooperative efficiency in obtaining the minimum unit cost of the RPO.

It can be concluded that all involved parties contributed to the plant operation. However, one of the long-term issues remains the inability to fully operate from farm gate to downstream, yet independently, as planned in the model and regulations.

3.4. Context Evaluation

This program is an initiative of various institutions coordinated by the Ministry of Cooperatives and SMEs. The cooperative, as an aggregator, will be the sole player from the farm gate to the downstream. Independent farmers as cooperative members will receive prices in the form of final products, and the public has more options to meet cooking oil needs. Collaboration with other parties is an option in this development model. It is a social process that involves doing certain things to help and understand each other in order to reach common goals (Syarbiah, Rianse, & Fausayana, 2024).

The documentation study found that the development plan has not been done comprehensively, which is seen from the issuance of regulations after the plant had been built. Meanwhile, the involvement of various parties who have played a role and the toll processing model implied that the plan has been done holistically, as it involved the PTPN Group on technology provision, as well as farmer groups and cooperatives as full implementers from farm gate to downstream, which is known as closed-loop agribusiness. The on-site formative evaluation revealed that the program's early stages did not perform as anticipated. The cooperative currently lacks a PK plant, and it outsources its FFB to CPO processing to the PTPN Group. Meanwhile, it is known that RPO processing from FFB requires two units of plant: FFB to CPO processing plant and CPO to RPO processing plant. In this study, POFMA only funded the development of CPO to RPO processing plants; thus, the closed-loop system is still dependent on other parties. The interview results showed that a very large investment is required to build FFB for CPO processing plants, which aligns with the capacity of the current RPO processing plant.

The study also showed that the goals and priorities of the program have yet to fulfill the needs of the targeted parties. Locke and Latham (2013) expressed five basic aspects in determining goals/settings: specific, measurable,

attainable/achievable, relevant, and time bound (Locke & Latham, 2013). First, the goal of the program has been detailed, focused, and reasoned, followed by the strategy to meet the purpose; second, the goal is in accordance with capability limits with concrete criteria to measure goal achievement; third, the industrial area has fulfilled Weber theory and is quite realistic, where the site selection is based on the principles of cost minimalization, as it is located adjacent to the OPP plant of the PTPN Group, which is also close to the crop location of cooperative members and supported by ministries; fourth, the goal relevance is less realistic as there is a limitation in plant facilities and infrastructure, also the available crops; and fifth, the time bound to reach the goals is still limited due to the toll processing model.

3.5. Input Evaluation

The Minister of Cooperative and SMEs Regulations on the management of cooperative-based RPO stated that cooperatives must provide human resources, raw materials, technology, product standardization, and marketing strategy (Petri et al., 2023). Input evaluation using conformity assessment checklist based on the regulations indicated that 1) the raw materials used for RPO production must come from the palm oil of cooperative members, the independent farmers; 2) all members must deliver all FFB to cooperate to be processed to RPO; 3) human resources need to come from cooperative members; 4) CPO as raw materials of RPO must come from members' FFB and processed independently by the cooperative using their own processing plant; 5) processing technology and packaging is done directly by the cooperative; 6) product standardization in accordance with existing regulations must be done by the cooperative; and 7) marketing strategy of the product must be done directly by the cooperative. The test results showed that there wasn't enough information about the RSPO certification of each farmer group or the existence of independent farmers' plant cultivation units as FFB sources. The cooperative needs to make a detailed inventory of the members' crop area, productivity, seed origin, and maintenance technique, especially on the use of fertilizers and chemical pesticides. One of the conditions for the smooth production of RPO is the sustainability of the FFB supply through timely harvest, amount, and quality, as it affects the free fatty acid content, which will eventually affect the RPO produced. Table 2 presents the raw and supplementary materials used for the RPO production.

Table 2. Raw and supplementary materials for RPO production.

Type of materials	Usage (Tonnes/Month)	Physical form
Raw materials		
-CPO	400	Semi liquid
Fractionation plant		
-RBDPO	110	Semi liquid
Supplementary materials		
-Bleaching earth	6	Liquid
-Phosphoric acid	0.2	Liquid
-Water	216	Liquid
-Salt	As needed	Solid
-Other ingredients	As needed	Solid
-Emulsifier	As needed	Solid

Source: Pujakesuma cooperative, North Sumatera, 2022.

3.6. Process Evaluation

In accordance with the regulations, the government has provided and will grant the CPO to the RPO processing plant to the cooperative. The cooperative can achieve RPO production through three models: independent, toll processing, and CPO purchase (Khatiwada, Palmén, & Silveira, 2021). The processing involves fractionation and soft refining. Fractionation, a process that separates Refined Bleached and Deodorized Palm Oil (RBDPO) into liquid (olein) and solid (stearin) fractions, is performed to retain nutritional content, especially total carotene (Ramli et al., 2020). Adding things like phosphoric acid and NaOH to this process makes it semi-continuous. At a certain temperature, it separates sap, free fatty acids, volatile compounds, and water residues. The process is followed by a continuous soft refinery to eliminate odors and retain oil stability (Mba, Dumont, & Ngadi, 2015). The law of conservation of mass states that mass cannot be made or destroyed; thus, the total incoming materials are equal to the total product mass and waste mass. The mass balance principle indicates that the total raw materials are equal to the total product, total waste, and mass of stored materials (López-Gómez, Iguaz-Gaínza, Esnoz-Nicuesa, & Martínez-Hernández, 2021). Based on this, the mass of RPO would be equal to the "total product," materials stored (total carotene and "other materials"), and total waste. Thus, it can be concluded that the stored mass of RPO was larger than that of commercial cooking oil. Figure 3 illustrates the fractionation and soft refinery process used in the production of refined palm oil (RPO). Fractionation is a process that separates Refined Bleached And Deodorized Palm Oil (RBDPO) into liquid (olein) and solid (stearin) fractions, which helps retain the nutritional content, particularly total carotene. A continuous soft refinery process follows, enhancing oil stability and minimizing odors.

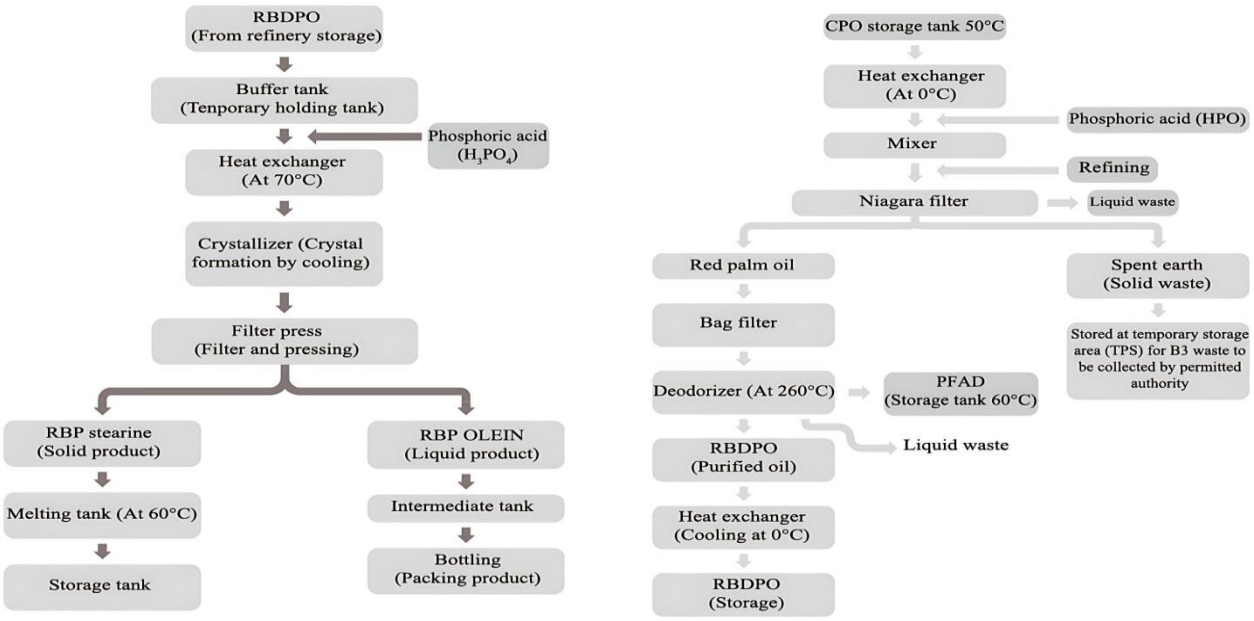

Figure 3. Fractionation and refinery plant.

Since the RPO production method is a change to the oil refining process, it is important to make sure that harmful substances are kept to a minimum to protect consumers in the long term. Hydrolyzed vegetable oil, such as palm cooking oil, contains 3-monochloropropane-1,2-Diol Ester (3-MCPDE) and Glycidyl Ester (GE). There are dangerous contaminants formed during refining at high temperatures, as they are carcinogenic. GE is both carcinogenic and genotoxic, which means it damages DNA (Yung, Lakshmanan, Kumaresan, Chu, & Tham, 2023) and is found in digestion systems. Many global health agencies have adjusted the Tolerable Daily Intake (TDI) of 3-MCPDE and GE in food products owing to their negative effects (Nik Azmi, Tan, Ang, & Leong, 2023). The precursors that lead to the formation of these contaminants are chlorine-containing fertilizers, phosphoric acid during the degumming stage, herbicides, diacylglycerol (DAG) in vehicles, a high level of bruises post-harvest, iron-containing tools, and groundwater (Chew, Abdul Hamid, Silvamany, & Tiong, 2022). These must be mitigated before FFB or CPO enters the refining and fractionation stages. Thus, the mitigation of 3-MCPDE and GE formations on RPO should be performed early at the farm gate level. The post-harvest mitigation step shortens and optimizes the distance between the plant area and location of the cooperative (farm gate). There is more 3-MCPDE in processed oil and vegetable fat, especially processed oil, than in unprocessed oil. This supports the idea that conditions are very important in creating 3-MCPDE and its esterified form (Mayayo, Oey, van der Fels-Klerx, & van Leeuwen, 2024).

3.7. Product Evaluation

RPO is not a novel product in Indonesia, as it has been widely produced in Java at the household scale. One of the goals of RPO production is to reduce the refinement cost so that the sales price is cheaper than bulk or premium cooking oil, thus making it more affordable to the public (Setiajiati et al., 2024). Table 3 presents a comparison of physiochemical characteristics between regular and cooking oils and RPO.

Table 3. Comparison of physico-chemistry characteristics of cooking oil and RPO.

Components	Regular cooking oil	Refined palm oil
Saturated fatty acid (% w/w)		
1.Lauric acid (C12:0)	0.17*	0.12****
2.Myristic acid (C14:0)	0.92**	0.61****
4.Palmitic acid (C16:0)	37.71*	34.05**
5.Stearic acid (C19:0)	3.76*	2.87****
Non-saturated fatty acid (% w/w)		
1.Oleic acid (C19:1)	42.56*	36.39**
2.Palmitoleic acid (C16:1)	0.14*	0.09**
3.Linoleic acid (C14:2)	13.59*	9.13**
5.Linolenic acid (C18:3)	0,27*	0,26**
Carotenoids (mg/kg)	536**	753**
Peroxide value (mEq/kg)	8.09**	3.98**
Vitamin A (IU)	43.6***	875****
Vitamin E (ppm)	323**	1.016****
Squalene (mg/kg)	128**	378**

Source: * Bonnie and Choo (2000), ** Ulberth and Buchgraber (2000), *** Rao and Lokesh (2003), **** Ping and Gwendoline (2006), Nebeling, Forman, Graubard, and Snyder (1997), **** Budiyanto, Silsia, Efendi, and Janika (2010).

Palmitic and oleic acids are two compounds that represent the dominant saturated and non-saturated fatty acids found in palm oil and are discussed the most in terms of their roles in consumer health (Nurhasanah & Munarso, 2024). Data from Table 3 show that despite the health benefits and abundant nutrients, products are still lacking when compared with conventional cooking oil. This product does not undergo perfect bleaching; thus, it has higher contaminants that could affect the quality and safety of the final product, such as a tarter taste and smell. The variability of RPO quality could also affect the non-uniformity of the final product, which is a challenge for the industry that requires consistent products.

The most interesting advantage of RPO is its lower peroxide value, which indicates that it can better preserve vitamin A content owing to photooxidation during distribution or storage (Ayu, Andarwulan, Hariyadi, & Purnomo, 2017). In addition to free-radical scavengers, some carotenoids are also known for their vitamin A activity, such as α-carotene, β-carotene, β-carotene, and β-cryptoxanthin (Eze et al., 2021). RPO contains 500 ppm carotenoids, consisting of 37% α-carotene, 47% β-carotene, 1.5% lycopene, and 6.9% cis-α-carotene (Van Rooyen, Esterhuyse, Du Toit, Lochner, & Engelbrecht, 2007). Thus, RPO can also be used as a substitute for synthetic vitamin A as a fortifying agent.

3.8. Indicative Production Cost of RPO

The output and outcome determine the agribusiness unit's performance. Output performance is assessed by productivity level, while the income level accepted by producers is an indicator of outcome performance (Bryceson & Slaughter, 2010). Thus, the outcome was an indicator of industrial success. One of the important conditions for reaching the optimum outcome level is high productivity, which should be followed by the economic efficiency of input use and output prices above the normal profit.

Table 4. Indicative production cost of RPO under independent scheme (10 tonnes/Day capacity).

Type of cost	Usage	Unit (Tonnes)	Unit cost* (IDR/Unit)	Cost per 10 tonnes/Day
FFB	52.632	kg	2,600	136,843,200*
Supplementary materials	0.17	ton	3,500,000	595,000
Fuels	220	Liter	6,800	1,496,000
Direct labour	80	Working days	120,000	9,600,000
Indirect cost**	-	-	-	2,750,000
Total				151,284,200

Note: *Processed secondary data; **wages, electricity, indirect labor, machine maintenance, inventory maintenance, laboratory supplies, depreciation of machines and tools, supplies, plants, and vehicles.

Table 4 presents the indicative production costs of refined palm oil (RPO) under an independent scheme with a daily production capacity of 10 tons. Assuming a yield of 19%, approximately 52.632 kg of fresh fruit bunches (FFB) is required to produce 10 tons of crude palm oil (CPO). At the current farm-gate price of IDR 2,600 per kg, the total cost for FFB amounts to IDR 136,843,200. Supplementary materials, fuel, and labor also contribute to the overall production costs, which culminate in an estimated cost price of IDR 13,615 per liter.

In an ideal cooperative-based RPO industry, the source of raw materials should be FFB from cooperative members. However, the operation utilized the second model of toll processing. In this model, FFB from cooperative members is processed at the partner company, the PTPN Group. The partner receives the yield level and charges processing fees to the cooperative. The yield level of palm oil is critical for the unit cost components of RPO (Gibon, De Greyt, & Kellens, 2007). It can be said that the current RPO production process has not met the criteria for closed-loop agribusiness, as there are some parts that are handed over to other parties. This is due to the absence of OPP plants owned by cooperatives. According to the regulations, the government only granted the cooperative a plant that processed CPO into RPO. However, the processing of FFB for CPO still relies on other parties. This plant requires a large investment, which is close to the investment required for RPO plants. In addition, there will be a time gap between CPO storage at the partner's plant and meeting the RPO plant capacity, where the partner will impose a storage fee. Thus, the production cost in this scheme is much higher than in the first scheme, which affects the sales price and cooperative income level. The lack of competition for the product will affect marketing; thus, the government is required to subsidize the product to achieve the goals of the program.

Figure 4 outlines the hierarchy for creating a development strategy for the PRO industry by setting the focus, criteria, and principles. With an inconsistency value of 0.05, the data showed that the top three strategies were to build the palm oil processing plant, get RSPO certification for the plantation, and use more efficient processing technology, both technically and financially. The development of FFB processing in CPO plants is a priority, as it will position cooperatives as the sole downstream player. The second most important strategy is the RSPO certification program for all independent oil palm agribusinesses, which is needed for the sustainability value of RPO. This will give a good impression of the safety of the final product, as it came from farms that are managed sustainably. The application of a more efficient processing technology, both technically and economically, is the third most important strategy. The production of the RPO aims to obtain the maximum profit with minimum cost. This is critical, especially when the price of FFB increases at the farmer level and farmers do not sell their products; the plant will experience a shortage of raw materials, which might lead to losses. Another important strategy includes collaboration with commercial cooking oil factories, as they could use RPO as a substitute for synthetic vitamin A as a fortificant. This is in line with the study by Solomons and Orozco (2003) who reported the use of RPO as a substitute for imported vitamin A as a fortificant.

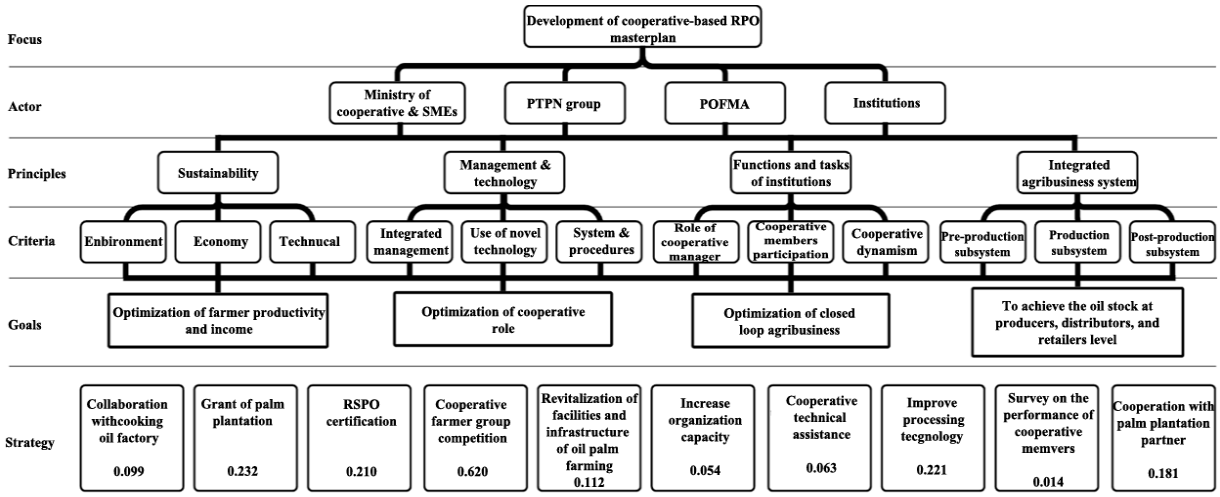

Figure 4. The priority of development strategy of closed loop RPO agribusiness.

4. CONCLUSION

The pilot program for downstreaming independent palm oil aims to ensure fair pricing for farmers and affordable cooking oil for consumers. Success depends on aligning plantation productivity with the RPO plant capacity, government subsidies to offset higher production costs, and continuous brand positioning. Strategic actions include supporting cooperatives with processing plants, obtaining RSPO certifications for independent plantations, and adopting efficient processing technologies. These measures are crucial for the program to effectively compete in the commercial palm oil market.

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