

Downstreaming Policy and Supply Chain Optimization in Indonesia's Palm Oil Industry

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ABSTRACT

Indonesia, as the world's largest palm oil producer, faces challenges in enhancing export competitiveness due to the dominance of crude palm oil (CPO). This study examines the impact of downstreaming policies on supply chain restructuring, operational efficiency, and value-added exports in Indonesia's palm oil industry during 2010–2025. Using trend analysis of secondary data from Statistics Indonesia (BPS), the Indonesian Palm Oil Association (GAPKI), and the Ministry of Industry, the findings reveal that downstreaming policies reduced the share of crude CPO exports from 57% (2010) to around 9% (2025), while processed product exports rose to more than 70%. Export value increased from USD 16.3 billion (2010) to USD 22.9 billion (2020), supported by biodiesel programs B30–B40, which also generated foreign exchange savings exceeding IDR 130 trillion. Furthermore, the palm oil sector absorbed approximately 5.2 million workers and contributed 3.5% to national GDP. These results highlight downstreaming as an effective operations management strategy aligned with Industry 4.0 initiatives, fostering supply chain efficiency, digital integration, and sustainable value creation for Indonesia's economy.

Keywords: downstreaming, operations management, supply chain optimization, Industry 4.0, palm oil, value-added exports

1. INTRODUCTION

The palm oil industry is one of the main pillars of Indonesia's economy. As one of the largest palm oil producers with a market share of more than 50% of total global production, Indonesia plays a strategic role in the global palm oil supply chain (Gabungan Pengusaha Kelapa Sawit Indonesia (GAPKI), 2025). However, Indonesia's palm oil exports are still dominated by crude palm oil (CPO) in raw form, which has relatively low added value compared to processed products such as cooking oil, margarine, oleochemicals, and biodiesel.

The Indonesian government has introduced downstream processing (hilirisasi) policies for raw materials, particularly palm oil, to ensure that they are not directly exported abroad but are first processed domestically. This aims to increase export value-added and strengthen the competitiveness of Indonesian products. The policy is implemented through various instruments such as tiered export taxes, special levies, mandatory biodiesel usage, and tax incentives for processing plants (Kementerian Perindustrian Republik Indonesia, 2025a). From an operations management perspective, this policy can be understood as a value chain strategy (Porter, 1985) designed to improve production efficiency, strengthen upstream-to-downstream integration, and create competitive advantage through value-added products. In addition, this approach aligns with the concept of lean operations, which seeks to reduce waste by maximizing the utilization of CPO for high-value processed products. However, research assessing the operational impact of this policy on export value enhancement remains limited (Lestari, 2025).

This study aims to: (1) analyze changes in the composition of Indonesia's palm oil exports before and after the downstreaming policy, and (2) measure the impact of downstreaming policies on the increase in value-added palm oil exports during the 2010–2025 period. The findings are expected to serve as an evaluation tool for policymakers in formulating future downstreaming strategies.

2. RESEARCH METHODOLOGY

2.1. Type of Research

This study employs a descriptive quantitative approach with a comparative method to describe and compare the conditions of Indonesia's palm oil exports before and after the implementation of downstreaming policies. The research focuses on export data from 2010–2025, covering volume, value, and the composition between crude palm oil (CPO) and processed products. The analysis was conducted in three stages: first, trend analysis using time series data to observe export developments; second, composition analysis using stacked bar charts to compare the proportion of CPO and processed products; and third, comparative analysis to assess changes in export value-added before and after the

downstreaming policy. The theoretical framework applied includes the value chain (Porter, 1985) to evaluate how downstreaming policies enhance production efficiency and export competitiveness, as well as operations performance metrics (Slack, 2022) to measure the policy's impact on the performance of the palm oil industry.

2.2. Type and Sources of Data

The data used in this study consist of annual time series secondary data for the period 2010–2025. The primary sources include Statistik Kelapa Sawit Indonesia published by Badan Pusat Statistik (BPS), production and export reports from Gabungan Pengusaha Kelapa Sawit Indonesia (GAPKI), and policy documents and industrial processing data from Kementerian Perindustrian Republik Indonesia.

2.3. Data Collection Technique

Data collection was carried out using documentation methods by accessing and downloading official publications from the websites of the respective institutions. The data obtained include annual time series for the period 2010–2025, covering export volume (tons), export value (US\$), the composition of exports between crude palm oil (CPO) and processed products, as well as downstreaming policy information issued by the government.

2.4. Data Analysis Technique

Data analysis was conducted through three complementary stages. The first stage was trend analysis, which used line charts to identify the development of export volume and value over the years. The second stage was composition analysis, utilizing stacked bar charts to compare the proportion of crude palm oil (CPO) and processed products in total exports. The third stage was comparative analysis, aimed at assessing changes in export value-added before and after the implementation of downstreaming policies.

3. RESULTS AND DISCUSSION

3.1. Changes in the Composition of Indonesia's Palm Oil Exports

The analysis of export composition shows a significant change in the structure of Indonesia's palm oil exports between 2010 and 2025. In 2010, before the downstreaming policy was implemented, crude palm oil (CPO) exports dominated with a share of 57% of total exports, while processed products accounted for 38% and final products only 5% (PASPI (Palm Oil Agribusiness Strategic Policy Institute), 2023).

Table 1. Composition of Indonesia's Palm Oil Exports (2010–2025)

	CPO Exports (%)	Processed Product Exports (%)	Final Product Exports (%)
2010	57%	38%	5%
2020	22%	67%	11%
2025	9%	70%+	21%

Source: (Badan Pusat Statistik (BPS), 2011; Gabungan Pengusaha Kelapa Sawit Indonesia (GAPKI), 2021, 2025)

The composition of Indonesia's palm oil exports in 2025 demonstrates a significant shift from raw materials to processed products. Out of a total export volume of 15.686 million tons, only 9% consisted of crude palm oil (CPO), while processed products accounted for the largest share at more than 70%. Value-added downstream products such as oleochemicals (2.384 million tons), biodiesel (2.384 million tons), and processed palm kernel oil (PKO) (738 thousand tons) contributed around 18% of total exports. These findings confirm that downstreaming policies have successfully redirected Indonesia's export orientation toward processed products with higher added value, in line with the diversification trend of the palm oil industry.

3.2. Development of Indonesia's Palm Oil Export Value

The development of Indonesia's palm oil export value shows an increase in line with the shift in export composition from raw products to processed products. In 2010, the total export value of palm oil was recorded at US\$16.3 billion and rose to US\$22.9 billion in 2020, an increase of about 40% within a decade (Badan Pusat Statistik (BPS), 2021). This growth continued with the implementation of biodiesel policies. The B30 program, launched in 2020, saved foreign exchange up to Rp63 trillion, while the B40 program in 2025 generated savings of more than Rp130 trillion (Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2025a, 2025b). These findings emphasize that downstreaming not only increases export value but also contributes to reducing dependence on fossil fuel imports.

3.3. Impact of Downstreaming Policy on Value-Added

The impact of downstreaming policies is reflected in the increase of value-added per unit of export. The selling price of crude palm oil (CPO) ranges between US\$600–800 per ton, while oleochemical products can reach US\$1,200–1,500 per ton, and processed biodiesel has an even higher added value (GAPKI, 2025).

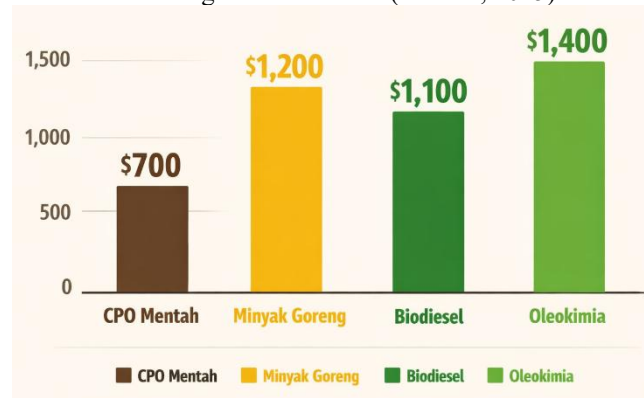


Figure 1. Comparison of Value-Added: CPO vs Processed Products (USD per ton)

In addition, downstreaming also creates a multiplier effect on the national economy. The upstream–downstream palm oil sector is able to absorb 5.2 million workers and contributes 3.5% to the national Gross Domestic Product (GDP) (Kementerian Perindustrian Republik Indonesia, 2025a). Palm oil export levies managed from 2015 to 2025 have accumulated around Rp182 trillion, with more than Rp152 trillion reinvested to support strategic programs such as sustainable palm oil development, smallholder plantation replanting, and biodiesel research and development (BPDPKS, 2025; Hasanah, 2025).

3.4. Case Study: Biodiesel Policies B30, B40, and B50 Projection

The implementation of mandatory biodiesel has become one of the main pillars of palm oil downstreaming policy. The program began with B15, then gradually increased to B20, B30, B40, and is targeted to reach B50 in 2026.

Table 2. Implementation of Biodiesel Policy in Indonesia

Scheme	Year of Implementation	Target Volume	Foreign Exchange Savings
B30	2020	9.6 million KL FAME	Rp63 trillion
B40	2025	15.6 million KL	>Rp130 trillion
B50	2026 (target)	19–20 million KL	Larger savings

Source: (GAPKI, 2025; Kementerian Energi dan Sumber Daya Mineral Republik Indonesia, 2025a; Muliawati, 2025)

The implementation of the B40 policy in January 2025 marked an important milestone in domestic palm oil downstreaming. GAPKI recorded that CPO consumption for biodiesel reached 12,704 thousand tons, an increase of 10.97% compared to the previous year, while the food sector declined by 3.64% to 9,834 thousand tons and oleochemicals rose by 1.22% to 2,234 thousand tons (GAPKI, 2026). The Ministry of Energy and Mineral Resources emphasized that “Mandatori B40 mulai berlaku 1 Januari 2025 dengan kuota biodiesel sebesar 15,6 juta KL” as a strategic step to reduce diesel imports and strengthen national energy resilience (Kementerian ESDM RI, 2025). In line with this, GAPKI highlighted that the B40 program “akan memperkuat energy resilience dan mengurangi ketergantungan pada energi fosil” (GAPKI, 2025).

The B50 target in 2026 is projected to require 19–20 million kiloliters of biodiesel, which has the potential to further increase domestic CPO absorption. The challenge ahead is to maintain a balance between meeting domestic needs for the biodiesel program and ensuring sufficient supply for exports.

3.5. Discussion

Based on the findings above, downstreaming policies have proven effective in increasing the value-added of Indonesia’s palm oil exports. This is consistent with previous studies which stated that industrial downstreaming can drive export revenue growth and job creation (PASPI, 2023).

However, several challenges still need to be anticipated. First, the B50 program has the potential to reduce the volume of CPO exports since most production will be absorbed by the domestic market. Second, the expansion of palm

oil plantation areas must continue to consider environmental sustainability aspects to avoid pressure from global markets that are increasingly concerned about deforestation issues.

4. CONCLUSION

Based on the results of the analysis and discussion, this study concludes that downstream policies have successfully transformed the composition of Indonesia's palm oil exports from crude CPO dominance (57% in 2010) to processed products (more than 70% in 2025). This change in composition has led to an increase in export value, reflected in the rise of total export value from USD 16.3 billion in 2010 to USD 22.9 billion in 2020, as well as foreign exchange savings of more than Rp130 trillion through the biodiesel program (PASPI, 2023).

In addition, downstream policies have also had a positive impact on the national economy through the absorption of around 5.2 million workers and a contribution of 3.5% to GDP, as emphasized by Kemenperin and Kemenko Perekonomian (Supianto, 2026; Ubaidillah, 2023). GAPKI recorded that CPO consumption for biodiesel reached 12,704 thousand tons in 2025, an increase of 10.97% from the previous year, while the food sector declined by 3.64% to 9,834 thousand tons and oleochemicals rose by 1.22% to 2,234 thousand tons (GAPKI, 2026). The Ministry of Energy and Mineral Resources added that "Mandatori B40 mulai berlaku 1 Januari 2025 dengan kuota biodiesel sebesar 15,6 juta KL" as a strategic step to strengthen national energy resilience (Kementerian ESDM RI, 2025).

Recommendations for the government include continuing downstream policies by strengthening cross-ministerial coordination, ensuring a balance between domestic CPO needs and exports, and integrating environmental sustainability aspects into every palm oil industry development policy. For future researchers, it is suggested to examine more deeply the impact of the B50 program on domestic CPO availability and Indonesia's export competitiveness in the global market.

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