

FROM GROWTH TO SUSTAINABILITY: PUBLIC POLICY LESSONS FROM INDONESIA'S PALM OIL SECTOR

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Abstract

This study examines how Indonesia's palm oil sector is transitioning from a growth-oriented development model to a sustainability-oriented one, and the public policy lessons that emerge from this shift. Using a qualitative research design based on an extensive literature review, policy and regulatory document analysis, and secondary datasets, the article synthesizes evidence on the economic, environmental, and social dimensions of palm oil expansion in Indonesia. The findings show that palm oil has significantly contributed to national income, export earnings, employment, and rural development, particularly through the rising role of smallholders. At the same time, rapid expansion has driven deforestation, peatland degradation, biodiversity loss, land conflicts, and persistent welfare gaps between large companies and smallholders. The study highlights how national instruments such as ISPO, moratoria on new forest and peatland concessions, and replanting and smallholder support schemes interact with international standards like RSPO and the European Union Deforestation Regulation (EUDR). Case studies of jurisdictional initiatives and social innovations demonstrate that policy mixes combining regulation, incentives, traceability, and multi-stakeholder collaboration can accelerate sustainability transitions, but governance fragmentation, capacity gaps, and data limitations constrain their effectiveness. The article concludes that adaptive, integrative, and evidence-based policy design anchored in institutional strengthening, digital traceability, and inclusive smallholder support is crucial for building a more sustainable and globally competitive palm oil sector in Indonesia.

Keywords: Indonesia; palm oil; public policy; sustainability transition; smallholders; policy mix; jurisdictional approaches

INTRODUCTION

The palm oil industry has long served as a cornerstone of Indonesia's economy, making a significant contribution to national income, exports, and rural development. Indonesia is the world's largest producer and exporter of palm oil, with plantation areas that have steadily expanded over the years (Watts et al., 2021; Putri et al., 2022). Palm oil is widely utilized in a diverse range of products, including food, cosmetics, and biofuels, thereby driving sustained growth in global demand for this commodity.

The rapid growth of the palm oil sector has generated substantial positive impacts on Indonesia's national economy. This sector provides millions of employment opportunities, increases rural household incomes, and stimulates infrastructure development in remote areas (Mulyasari et al., 2023; Supriatna et al., 2024). Smallholders play an increasingly pivotal role, with their contribution to total national production continuing to rise (Eggen et al., 2024; Pramudya et al., 2022). This transformation has reshaped the social and economic structures of many regions across Indonesia, positioning palm oil as a strategic commodity that influences not only the national economy but also the livelihoods of millions of individuals at the local level.

Despite its substantial economic contributions, the expansion of the palm oil industry has also generated complex environmental and social challenges. The growth of oil palm plantations is frequently associated with deforestation, peatland degradation, biodiversity loss, and large-scale land-use change (Gaveau et al., 2022; Zhao et al., 2022). Recent studies indicate that nearly one-third of the primary forest areas cleared in Indonesia have been left abandoned, creating new challenges for land governance and sustainability initiatives (Parker et al., 2024). The conversion of primary forests into oil palm plantations has emerged as a critical global concern, particularly given that Indonesia hosts one of the world's largest tropical forest areas, which play a vital role in carbon sequestration and ecosystem preservation.

In addition to its environmental consequences, the expansion of the palm oil industry has also generated a series of social challenges, such as land conflicts between companies, smallholders, and indigenous communities, as well as disparities in welfare between large-scale enterprises and small farmers (Watts et al., 2021; Reich & Musshoff, 2025). Many smallholders face persistent barriers in accessing markets, obtaining sustainability certification, and sustainably enhancing productivity. Recent advances in sustainable palm oil production and zero-deforestation initiatives have become central themes in scholarly discussions, as illustrated by Ostfeld and Reiner (2024), who highlight policy innovations alongside implementation challenges at both global and national scales. The adoption of zero-deforestation criteria by the RSPO constitutes one of the most significant innovations within private sustainability standards for the palm oil industry. At the same time, strategies employed by Indonesian palm oil companies to navigate the intersection of zero-deforestation commitments and the state's zero-tolerance policies have emerged as a critical issue in ensuring industry sustainability. Dermawan, Hospes, and Termeer (2022) underscore how companies must adapt to increasingly stringent global market demands and national regulatory frameworks.

Projections of global oil palm expansion under zero-deforestation commitments indicate both direct and indirect impacts on land-use change, as outlined by Leijten et al. (2023). Jespersen, Grabs, and Gallemore (2024) demonstrate that dynamics of competition among industry actors can accelerate the advancement of sustainability standards. At the same time, the sector's dependence on exports and exposure to global price fluctuations render it vulnerable to external pressures, with potential direct consequences for smallholder livelihoods and the stability of local economies (Ekaputri et al., 2025).

In recent decades, global attention to sustainability issues has intensified. Consumer countries, particularly within the European Union, have begun to implement stringent regulations on products linked to deforestation, such as the European Union Deforestation Regulation (EUDR) (European Union, 2023). Policy negotiations on palm oil between the European Union and Indonesia, alongside the dynamics of public discourse, have become critical factors shaping the formulation of regulations and sustainability standards, as highlighted by Kettunen and Pratiwi (2025).

Recent analyses reveal significant gaps between voluntary sustainability standards such as the RSPO and ISPO and the regulatory requirements of the EUDR, thereby necessitating policy adjustments and harmonization of standards to ensure compliance of Indonesian palm oil products in global markets (Cosimo et al., 2024). International standards such as the Roundtable on Sustainable Palm Oil (RSPO) have also become key benchmarks for exporters seeking access to international markets (RSPO, 2024). These global pressures compel both the Indonesian government and industry actors to adapt by enhancing transparency and adopting more environmentally responsible production practices.

The Indonesian government has responded by strengthening national policies, including the implementation of the Indonesian Sustainable Palm Oil (ISPO) certification scheme, the moratorium on new permits in forest and peatland areas, and a range of incentives designed to support smallholders in adopting sustainable practices (Republic of Indonesia, 2020, 2025; Ministry of Agriculture, 2020). The impact of palm oil certification on production efficiency is not only a concern in Indonesia but also in other producing countries such as Malaysia. Zachlod et al. (2025) demonstrate that the adoption of sustainability certification can indirectly affect production efficiency, which warrants careful consideration in policy formulation. Nevertheless, the implementation of these policies faces multiple challenges, including limited smallholder capacity, fragmented governance structures, and overlaps between national and international standards (Pramudya et al., 2022; Watts et al., 2021; Choiruzzad et al., 2021).

The transition from growth to sustainability in Indonesia's palm oil sector is far from straightforward. This paradigm shift requires the integration of economic, social, and environmental interests, as well as multi-actor collaboration across local, national, and international levels (Bahruddin et al., 2024; Astari et al., 2025). Jurisdictional approaches, social innovations, and the strengthening of institutional capacity are key to accelerating the transformation toward a sustainable and inclusive palm oil industry (Adiwinata et al., 2025; Pribadi et al., 2023; Bahruddin et al., 2024).

Lessons from Indonesia's experience are highly relevant for other countries facing similar dilemmas between economic growth and environmental sustainability. Policy integration (policy mix), institutional strengthening, and social innovation have proven to be more effective than single-policy approaches in addressing the complexity of challenges in the palm oil sector (Cejudo & Michel, 2021; Alkemade & de Coninck, 2021). The application of policy mixes that combine regulation, incentives, and social innovation has demonstrated effectiveness in driving socio-technical transitions toward sustainability, as outlined by Rogge and Stadler (2023).

This article aims to provide an in-depth examination of public policy lessons from the transition from growth to sustainability in Indonesia's palm oil sector. By integrating empirical studies, policy analysis, and governance theory, it offers strategic recommendations for policymakers, industry actors, and civil society in addressing the challenges and opportunities of sustainability.

1. The historical development of Indonesia's palm oil industry and its economic, social, and environmental impacts.
2. The dynamics of public policies and regulations shaping the transformation of the palm oil sector.
3. Case studies and local initiatives that have successfully promoted sustainable practices.
4. Public policy lessons that can be adopted to strengthen the transition toward a sustainable and inclusive palm oil industry.

Through a comprehensive approach, this article is expected to provide a substantive contribution to the development of public policies that are more adaptive, integrative, and sustainability-oriented within Indonesia's palm oil sector.

To achieve these objectives, this article is structured into several main sections. The first section discusses the historical growth of Indonesia's palm oil sector, highlighting its driving factors and resulting impacts. The second section examines public policies and regulations at both national and international levels, as well as the challenges of their implementation. The third section presents case studies and local initiatives that have successfully promoted sustainable practices. The fourth section synthesizes public policy lessons that can be adopted to strengthen the transition toward a sustainable palm oil industry. Institutional change and policy experimentation are argued to accelerate the adoption of sustainability innovations, in line with the findings of Kivimaa and Rogge (2022), who emphasize the critical role of policy-institutional interactions in transition processes. The final section outlines conclusions and provides strategic recommendations for policymakers and stakeholders.

LITERATURE REVIEW

Public Policy and Sustainability Theory. Studies on public policy and sustainability in strategic commodity sectors such as palm oil frequently draw upon governance and institutional theories. Mazmanian and Sabatier (1983) emphasize the importance of effective policy implementation through the design of appropriate instruments, inter-agency coordination, and adaptation to local dynamics. Ostrom (2015) and North (1990) highlight the critical role of institutions in governing common-pool resources and fostering collective behavioral change. Within the context of sustainability transitions, Cejudo and Michel (2021) as well as Alkemade and de Coninck (2021) underscore the necessity of policy integration (policy mix) that combines regulation, incentives, and social innovation to achieve long-term objectives.

Growth of the Palm Oil Industry and Economic Impacts. The literature demonstrates that the growth of Indonesia's palm oil industry has made substantial contributions to the national economy. Watts et al. (2021) and Putri et al. (2022) document how the expansion of oil palm plantations has increased rural household incomes, created employment opportunities, and stimulated infrastructure development. The role of smallholders has become increasingly significant, with their contribution to total national production continuing to rise (Eggen et al., 2024; Pramudya et al., 2022). However, this growth has also generated challenges, including dependence on exports, exposure to global price fluctuations, and persistent welfare disparities between large-scale enterprises and smallholders (Ekaputri et al., 2025).

Environmental and Social Impacts. The expansion of oil palm plantations in Indonesia has been identified as one of the primary drivers of tropical deforestation in Southeast Asia. Gaveau et al. (2022) and Zhao et al. (2022) demonstrate that the conversion of primary forests into oil palm plantations has resulted in the loss of millions of hectares of forest cover, reduced carbon sequestration capacity, and posed severe threats to biodiversity. Peatland degradation has also emerged as a global concern due to the substantial release of carbon emissions into the atmosphere. The social impacts of palm oil expansion are equally complex. Land conflicts between companies, smallholders, and indigenous communities frequently arise as a result of unclear land tenure and weak law enforcement (Watts et al., 2021; Reich & Musshoff, 2025). Inequalities in access to technology, capital, and markets constrain smallholders' ability to enhance productivity and obtain sustainability certification (Eggen et al., 2024; Pramudya et al., 2022). Moreover, shifts in local economic and cultural structures driven by the transition from traditional agriculture to oil palm cultivation have become a central concern in the literature (Mulyasari et al., 2023; Supriatna et al., 2024).

Public Policy and Regulation. The Indonesian government has adopted a range of policies to mitigate the negative impacts of oil palm expansion and to promote sustainable practices. The implementation of the Indonesian Sustainable Palm Oil (ISPO) certification scheme and the moratorium on new permits in forest and peatland areas represent important steps in curbing deforestation and strengthening environmental governance (Republic of Indonesia, 2020, 2025; Ministry of Agriculture, 2020; Groom et al., 2022). However, the implementation of these policies faces several challenges, including limited smallholder capacity, fragmented governance structures, and overlaps between national and international standards (Pramudya et al., 2022; Watts et al., 2021; Choiruzzad et al., 2021). At the global level, standards such as the Roundtable on Sustainable Palm Oil (RSPO) and the European Union Deforestation Regulation (EUDR) exert additional pressure on Indonesia's palm oil industry to enhance transparency and sustainability within supply chains (RSPO, 2024; European Union, 2023). The adoption of RSPO certification among smallholders remains limited due to high costs and the complexity of the certification process (Eggen et al., 2024; Ekaputri et al., 2025). The EUDR requires palm oil entering the European market to be deforestation-free and supported by strict traceability systems, thereby necessitating large-scale adjustments at the national level (ISPO & EFI, 2024; Reboah et al., 2024).

Innovation and Sustainability Initiatives. Recent literature highlights the importance of social innovation and collaborative approaches in advancing sustainability within the palm oil sector. Jurisdictional approaches in several regions, such as Riau and Kalimantan, have enabled the integration of traceability systems, the harmonization of certification standards, and the strengthening of institutional capacity at the local level (Bahruddin et al., 2024; Adiwinata et al., 2025). Incentives for smallholders to participate in certification schemes—such as technical assistance and access to finance have proven effective in enhancing participation and improving production quality (Pramudya et al., 2022; Watts et al., 2021). Social innovations, including the strengthening of farmer cooperatives and the use of digital technologies for land monitoring, have also emerged as key drivers in accelerating the transition toward sustainability (Pribadi et al., 2023; Mulyasari et al., 2023). Nevertheless, challenges persist, including institutional fragmentation, limited social capital, and resistance to change (Putri et al., 2022; Astari et al., 2025).

Gaps and Challenges in the Literature. Although extensive research has been conducted, several gaps remain to be addressed by future studies. First, the effectiveness of integrative policies and jurisdictional approaches at the national scale has yet to be comprehensively tested. Second, the long-term impacts of international regulations such as the EUDR on smallholders and domestic supply chains require further investigation. Third, the adoption of digital technologies for monitoring and traceability continues to face challenges in terms of uptake and cross-sectoral data integration. In addition, the literature underscores the need for periodic evaluations of implemented policies and the active involvement of local communities and stakeholders in decision-making processes. Multi-stakeholder collaboration and the strengthening of local institutions are essential prerequisites for ensuring the long-term sustainability of the palm oil sector.

Conclusion of the Literature Review. This review highlights that the transition of Indonesia's palm oil sector from a growth-oriented trajectory toward sustainability constitutes a highly complex and multidimensional process. Theoretical perspectives on public policy and governance, combined with empirical evidence on economic, environmental, and social dimensions, underscore the interdependence of regulatory frameworks, institutional arrangements, and local initiatives. Furthermore, policy innovations and jurisdictional approaches emerge as critical pathways for reconciling competing objectives of economic development, social inclusion, and environmental protection. The gaps identified particularly regarding the effectiveness of integrative policy frameworks, the long-term implications of international regulations, and the adoption of digital traceability systems indicate significant opportunities for further scholarly inquiry. Collectively, these insights provide a foundation for advancing both academic debates and practical strategies aimed at fostering an inclusive, sustainable, and globally competitive palm oil industry.

METHODOLOGY

This study adopts a qualitative research design, employing a literature review and public policy analysis as the primary methods. The central focus is to identify, examine, and synthesize policy lessons derived from Indonesia's transition from a growth-oriented to a sustainability-oriented palm oil sector. The analysis integrates a wide range of primary and secondary sources, including peer-reviewed journal articles, policy reports, regulatory documents, and empirical data related to the palm oil industry. By triangulating these diverse materials, the study seeks to generate a comprehensive understanding of the policy dynamics, institutional arrangements, and governance challenges underpinning the sustainability transition.

The empirical foundation of this study is drawn from three main sources:

1. Literature Review: A systematic search and analysis of relevant scholarly publications, including peer-reviewed articles from leading international journals such as World Development, Land Use Policy, Scientific Reports, and Sustainability. References were compiled through a structured bibliographic review process.
2. Policy and Regulatory Documents: Examination of official government documents from Indonesia, including Presidential Decrees and Ministry of Agriculture Regulations, alongside international regulatory frameworks such as the European Union Deforestation Regulation (EUDR) and voluntary sustainability standards such as the Roundtable on Sustainable Palm Oil (RSPO).
3. Reports and Empirical Datasets: Utilization of data from international organizations, non-governmental organizations, and supply chain datasets, including Trase, CIFOR reports, and the RSPO Impact Report.

The analysis was conducted thematically and descriptively, following a structured sequence of steps:

1. Reference Categorization: Each source was classified according to key thematic areas, including industry growth, public policy, sustainability, socio-environmental challenges, and institutional innovation.
2. Synthesis of Findings: Information from multiple sources was synthesized to identify patterns, trends, and relevant policy lessons.
3. Policy Analysis: Drawing on public policy and governance theories (Mazmanian & Sabatier, 1983; Ostrom, 2015; Cejudo & Michel, 2021), the study evaluated the effectiveness, challenges, and opportunities of policies implemented in the palm oil sector.
4. Case Studies: Selected local initiatives and jurisdictional approaches were analyzed as case studies to provide deeper insights into the practical implementation of sustainability practices on the ground.

To ensure the validity and reliability of the analysis, data triangulation was employed by comparing findings across multiple types of documents and publications.

Additionally, the interpretation of results was guided by internationally recognized theories and practices in public policy, thereby reinforcing the rigor and credibility of the study's conclusions.

This study has several limitations. First, it relies primarily on secondary sources and publicly available documents. Second, no primary data collection, such as interviews or field surveys, was conducted. Third, the analysis emphasizes the synthesis of literature and policy documents, which means that the findings are primarily descriptive and analytical in nature.

RESULTS AND DISCUSSION

Growth Dynamics and Economic Impacts. Indonesia's palm oil industry has experienced rapid expansion since the late 20th century, positioning the country as the world's largest producer and exporter of palm oil. This growth has been driven by government policies supporting plantation expansion, private sector investment, and global demand for versatile vegetable oils (Watts et al., 2021; Putri et al., 2022). Initially, large companies and state-owned plantations dominated production; however, since the 2000s, the role of smallholders has become increasingly prominent, contributing over 40% of the total national oil palm plantation area (Eggen et al., 2024; Pramudya et al., 2022).

To provide a comprehensive overview of the scale and dynamics of Indonesia's palm oil industry, Table 1 summarizes key statistical indicators, including plantation area, production and export volumes, smallholder participation, and deforestation trends. These data, sourced from official statistics and recent publications, form the empirical basis for the subsequent analysis and enhance the relevance and currency of the discussion.

Table 1. Summary of the Indonesian Palm Oil Industry (2024–2025)

Indicator	Latest Data (2024–2025)	Main Sources
Oil palm plantation area	16.8–17.5 million ha	BPS, Directorate, General of Plantations, Mapbiomas
Palm oil production	46.5–52.7 million tons	GAPKI, USDA, BPS
Palm oil exports	21.6–29.5 million tons (USD 20–27.7 billion)	BPS, GAPKI, USDA
Smallholder land area	6.76–6.9 million ha (41.3% of total)	Directorate General of Plantations, HITI
Number of smallholder households	2.6 million	Directorate General of Plantations, HITI
Independent RSPO-certified farmers	34,403	Katadata / RSPO
Deforestation due to palm oil	30,000 ha (2023, +36% from 2022)	Forest Digest, Semarak News
Total palm oil-related deforestation	3 million ha (last two decades)	Kompas, Trase

Based on the data presented in Table 1, it is evident that Indonesia's palm oil industry has experienced substantial growth over the past two decades. Plantation area and production volumes have steadily increased, supported by the significant role of smallholders, who manage nearly half of the total plantation area. However, this expansion has also been accompanied by serious challenges, particularly regarding deforestation and environmental sustainability. The persistent deforestation trends highlight the need for more effective and collaborative policies to balance economic growth with environmental conservation. These data provide a critical foundation for further analysis of the economic, social, and environmental impacts of the palm oil industry in Indonesia.

To illustrate the dynamics of production and export growth, Figure 1 presents the trends in Indonesian palm oil production and exports from 2010 to 2024.

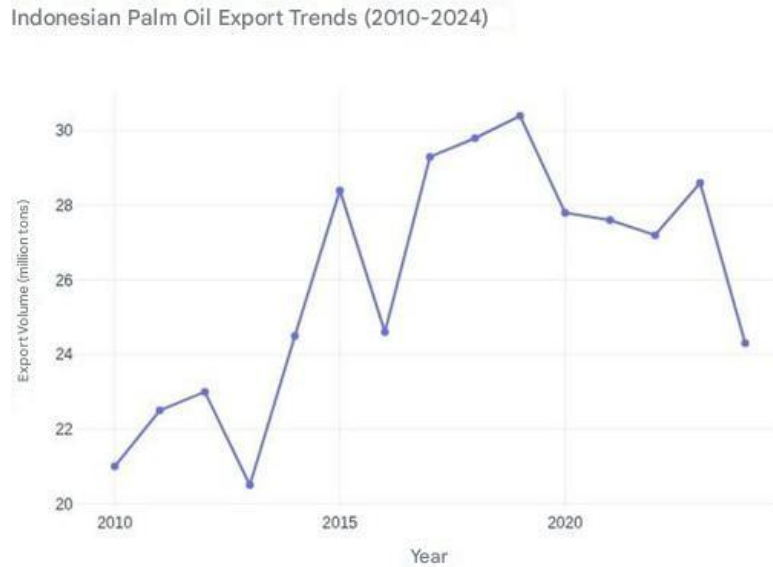


Figure 1. Trends in Indonesian Palm Oil Exports (2010–2024)

This figure illustrates the dynamics of Indonesia’s palm oil export volumes over the past 15 years, showing fluctuating trends with notable increases in certain years. The data are derived from BPS and GoodStats.

The economic contribution of the palm oil sector in Indonesia is highly significant. The industry accounts for more than 10% of the country’s non-oil and gas exports and provides millions of jobs, particularly in rural areas (Mulyasari et al., 2023; Supriatna et al., 2024). Increased household incomes and the development of infrastructure in palm oil-producing regions are among the sector’s primary positive impacts. Furthermore, palm oil stimulates the growth of related economic sectors, including financial services, trade, and processing industries.

Figure 2 presents a summary of key statistical data for Indonesia’s palm oil industry. To illustrate the dynamics of production growth, Figure 3 shows trends in Indonesian palm oil production from 2010 to 2024.

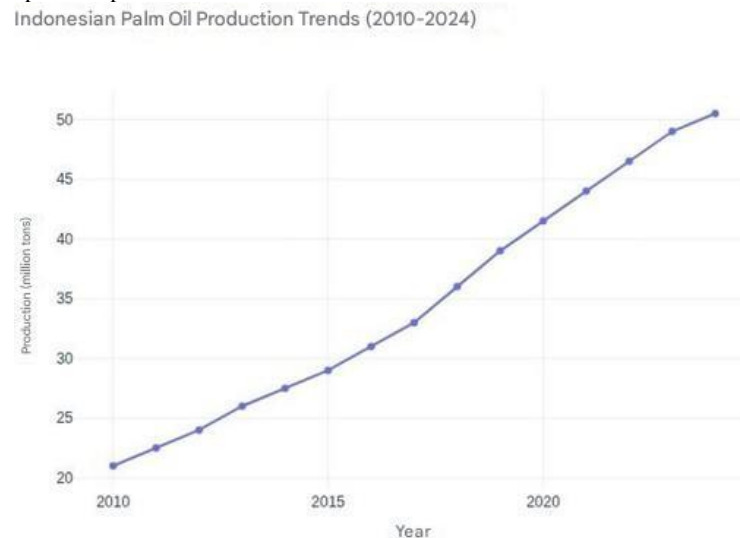


Figure 2. Trends in Indonesian Palm Oil Production (2010–2024)

The above figure illustrates a consistent increase in palm oil production over the past two decades, reflecting plantation expansion and enhanced industrial capacity. This trend provides a critical basis for analyzing the economic contributions of the sector as well as the sustainability challenges associated with Indonesia’s palm oil industry. However, this rapid growth also presents significant challenges. Smallholders face limited access to technology, capital, and market information, which constrains productivity and product quality (Eggen et al., 2024; Pramudya et al., 2022). Ensuring the resilience of smallholders to future industry challenges is a critical issue for the development of Indonesia’s palm oil sector. Hendrawan, Chrisendo, & Musshoff (2024) emphasize the need for adaptive strategies and capacity-building measures to enable smallholders to cope with market, regulatory, and technological changes. The role of smallholders in Indonesia’s palm oil industry has become increasingly important, yet they encounter multiple barriers in sustainability certification processes, such as RSPO. Pre-certification conditions and the challenges faced by independent smallholders are crucial factors influencing the successful implementation of RSPO certification. De Vos et al. (2023) report that many smallholders still experience administrative, technical, and informational constraints before meeting certification requirements. Sustainability certification schemes such as ISPO and RSPO involve costs and requirements that are often difficult for smallholders to fulfill, limiting their access to premium markets (Watts et al., 2021; Reich & Musshoff, 2025).

Furthermore, dependence on exports and fluctuations in global prices render the sector vulnerable to external pressures, directly affecting smallholder incomes and local economic stability (Ekaputri et al., 2025). The environmental impacts of palm oil plantation expansion are also significant. The conversion of primary forests and peatlands into oil palm plantations has led to deforestation, soil degradation, and loss of biodiversity (Gaveau et al., 2022; Zhao et al., 2022). In addition, land conflicts among companies, smallholders, and indigenous communities frequently occur, complicating governance and creating legal uncertainties (Watts et al., 2021; Reich & Musshoff, 2025).

To address these challenges, the government and industry actors have developed various innovations, including the implementation of ISPO and RSPO certifications, as well as jurisdictional approaches in certain regions to enhance traceability systems and strengthen smallholder capacities (Adiwinata et al., 2025; Ekaputri et al., 2025). Social innovations, such as the empowerment of farmer cooperatives and the utilization of digital technologies for land monitoring, have also been key in accelerating the transition toward sustainability (Pribadi et al., 2023; Mulyasari et al., 2023). In summary, the growth dynamics of Indonesia's palm oil industry demonstrate considerable economic potential; however, the sector concurrently faces substantial challenges related to environmental management, governance, and long-term sustainability. Ensuring the resilience of smallholders, promoting social innovations, and implementing integrated, cross-sectoral policy frameworks are essential for advancing a more inclusive, equitable, and environmentally sustainable palm oil sector.

Environmental and Social Impacts. The rapid expansion of Indonesia's palm oil industry has generated significant environmental impacts, particularly concerning deforestation and peatland degradation. Oil palm plantation expansion is a major driver of tropical forest loss in Southeast Asia, resulting in reduced carbon sequestration capacity and heightened threats to biodiversity (Gaveau et al., 2022; Zhao et al., 2022). The conversion of primary forests into oil palm monocultures has diminished habitats for endemic species, including orangutans and Sumatran tigers, while increasing the risk of peatland fires and associated carbon emissions into the atmosphere.

In addition to ecological consequences, the expansion of oil palm plantations has generated various social challenges. Land conflicts between companies, smallholders, and indigenous communities frequently arise due to unclear land tenure and weak law enforcement (Watts et al., 2021; Reich & Musshoff, 2025). Such disputes can result in the marginalization of local communities, restricted access to natural resources, and social inequities. Governance fragmentation across central and local governments, as well as certification bodies, further complicates conflict resolution and hampers sustainable development efforts (Putri et al., 2022; Astari et al., 2025).

From a welfare perspective, smallholders face substantial challenges in enhancing productivity and accessing premium markets. Sustainability certification schemes, such as ISPO and RSPO, involve costs and compliance requirements that are often difficult for smallholders to meet, resulting in their limited participation in global supply chains (Eggen et al., 2024; Pramudya et al., 2022). International studies indicate that certification and transnational supply chains are also critical issues in other producing countries, such as Guatemala, which confronts similar challenges in linking local production to global consumer markets (VanderWilde et al., 2023). Furthermore, dependence on a single commodity and fluctuations in global palm oil prices render smallholder incomes unstable and highly vulnerable to changes in international policy and market conditions (Ekaputri et al., 2025).

Another social impact of palm oil expansion is the transformation of local economic and cultural structures. The shift from traditional agriculture to oil palm plantations alters livelihood patterns, social systems, and even cultural identities of local communities (Mulyasari et al., 2023; Supriatna et al., 2024). Labor migration to palm oil-producing regions also places pressure on local infrastructure, including healthcare and educational facilities, thereby affecting community well-being and social cohesion.

To mitigate these environmental and social impacts, the government and industry stakeholders have implemented policies such as moratoriums on new permits in forest and peatland areas, as well as promoting sustainability certification and jurisdictional approaches in selected regions (Groom et al., 2022; Republic of Indonesia, 2020, 2025; RSPO, 2024; Adiwinata et al., 2025). Social innovations, including the strengthening of farmer cooperatives and the use of digital technologies for land monitoring, have also been pivotal in accelerating the transition toward a more sustainable palm oil sector (Pribadi et al., 2023; Mulyasari et al., 2023).

In summary, the environmental and social impacts of Indonesia's palm oil industry necessitate public policies that are more integrative, collaborative, and oriented toward social equity and environmental conservation. Multi-stakeholder collaboration and the strengthening of local institutions are essential prerequisites for ensuring the long-term sustainability of the sector.

Public Policy Implementation and Regulation. The transition of Indonesia's palm oil sector toward sustainability is strongly influenced by public policies and regulations at both national and international levels. The Indonesian government has adopted various strategic policies to mitigate the negative impacts of oil palm expansion, enhance smallholder welfare, and meet global market demands for environmentally sustainable products. One of the primary national policies is the implementation of the Indonesian Sustainable Palm Oil (ISPO) certification, which aims to ensure sustainable palm oil production in compliance with environmental standards (Republic of Indonesia, 2020, 2025; Ministry of Agriculture, 2020). ISPO requires all industry actors, including smallholders, to meet certification criteria encompassing environmental, social, and economic dimensions. However, the implementation of ISPO faces several challenges, including limited smallholder capacity, restricted access to information, and certification costs (Pramudya et al., 2022; Watts et al., 2021).

In addition to ISPO, the government has implemented a moratorium on new permits in forest and peatland areas as a measure to curb deforestation and protect ecosystems (Groom et al., 2022; Gaveau et al., 2022). This policy has been considered effective in reducing the conversion of primary forests, although its contribution to Indonesia's commitments under the Paris Agreement remains limited. At the global level, standards such as the Roundtable on Sustainable Palm Oil (RSPO) and the recent European Union Deforestation Regulation (EUDR) exert additional pressure on Indonesia's palm oil industry to enhance supply chain transparency and sustainability (RSPO, 2024; European Union, 2023). RSPO has become a key benchmark for exporters seeking access to international markets; however, adoption among smallholders remains limited due to cost constraints and the complexity of the certification process (Eggen et al., 2024; Ekaputri et al., 2025).

The European Union Deforestation Regulation (EUDR), which came into effect in 2023, mandates that palm oil products entering the EU market must be deforestation-free and accompanied by a stringent traceability system (European Union, 2023; ISPO & EFI, 2024). This regulation requires substantial national-level adjustments, including data harmonization, enhanced monitoring capacity, and the integration of domestic certification systems with international standards (Reboah et al., 2024; Benedict et al., 2024).

The implementation of public policies in Indonesia's palm oil sector faces multiple challenges, including limited smallholder capacity to comply with certification requirements (Watts et al., 2021; Reich & Musshoff, 2025), governance fragmentation across central and local governments and certification bodies (Putri et al., 2022; Astari et al., 2025), as well as regulatory overlaps and competition between national and international standards (Choiruzzad et al., 2021; Macdonald et al., 2024). Data gaps and traceability deficiencies within supply chains further exacerbate these challenges (Benedict et al., 2024; Trase, 2024).

To address these challenges, various initiatives have been developed, including jurisdictional approaches, policy mix integration, and institutional capacity strengthening (Bahruddin et al., 2024; Macdonald et al., 2024). Multi-stakeholder collaboration among government, private sector, civil society, and international communities is pivotal to ensuring effective and sustainable policy implementation.

Case Studies and Sustainability Initiatives. The transition toward sustainability in Indonesia's palm oil sector relies not only on national policies and international regulations but also on local innovations and initiatives led by diverse stakeholders. Case studies from several regions indicate that collaborative and adaptive approaches can accelerate the transformation of the palm oil industry toward more environmentally friendly and inclusive practices. One of the notable innovations is the jurisdictional approach, in which local governments, companies, smallholders, and civil society organizations collaborate to achieve sustainability targets at the provincial or district level (Bahruddin et al., 2024; Adiwinata et al., 2025). This approach enables the integration of traceability systems, harmonization of certification

standards, and strengthening of institutional capacity at the local level. Studies in Riau and Kalimantan indicate that cross-actor collaboration can enhance smallholder access to certified markets and improve environmental governance (Adiwinata et al., 2025; Ekaputri et al., 2025).

In addition to jurisdictional approaches, incentives for smallholders to participate in sustainability certification play a crucial role in enhancing engagement and production quality. Technical assistance, training, and access to finance have proven effective in improving smallholders' capacity to meet ISPO and RSPO certification requirements (Pramudya et al., 2022; Watts et al., 2021). Initiatives such as replanting with high quality seedlings and adopting sustainable agronomic practices also contribute to increased productivity while reducing pressure on forested areas. Replanting among Indonesian smallholder oil palm farmers represents a significant challenge but offers a substantial opportunity to enhance sector productivity and sustainability. Replacing unproductive smallholder plantations can significantly advance the achievement of the Sustainable Development Goals in Sumatra, Indonesia (Fosch et al., 2023). However, various constraints, including limited access to finance, technical knowledge gaps, and inadequate institutional support pose challenges in the replanting process (Petri et al., 2024).

Social innovations, such as the strengthening of farmer cooperatives and the utilization of digital technologies for land monitoring, are pivotal in accelerating the transition toward sustainability (Priyadi et al., 2023; Mulyasari et al., 2023). Farmer cooperatives enhance smallholders' bargaining power in the market, improve access to information, and facilitate the certification process. Concurrently, digital technologies enable real-time land monitoring, transparent reporting, and data integration that supports robust traceability systems.

Despite these efforts, significant challenges persist. Institutional fragmentation, limited social capital, and resistance to change continue to impede the implementation of sustainability initiatives (Putri et al., 2022; Astari et al., 2025). Furthermore, harmonization between national and international standards, as well as adjustments to new regulations such as the EUDR, require intensive coordination across all levels of government and industry. Collectively, the case studies and local initiatives in the Indonesian palm oil sector indicate that sustainability can be effectively promoted through multi-stakeholder collaboration, social innovation, and institutional capacity enhancement. These experiences provide valuable policy insights for other countries confronting analogous challenges in aligning economic growth with environmental conservation and social equity.

Public Policy Lessons

Indonesia's experience in managing the transition of the palm oil sector from growth-oriented expansion to sustainability provides critical insights for public policy formulation in strategic commodity sectors. Governance of sustainable commodities in Global South countries, including Indonesia, is confronted with multifaceted challenges in policy integration and the implementation of international standards (van der Ven, Sun, & Cashore, 2021). The complexity of these challenges encompassing environmental, social, and governance dimensions necessitates policy approaches that are adaptive, integrative, and collaborative, ensuring both sectoral resilience and alignment with global sustainability objectives. First, policy integration, or a *policy mix*, has been demonstrated to be more effective than singular approaches. The combination of regulatory measures, economic incentives, and cross-sectoral collaborative initiatives can drive behavioral change among industry actors and smallholders (Cejudo & Michel, 2021; Alkemade & de Coninck, 2021). For instance, the implementation of ISPO and RSPO certifications, supported by technical assistance and financing mechanisms, alongside moratoria on new permits in forested areas, has positively influenced deforestation rates and promoted sustainable production practices. The effectiveness of this approach is evidenced in jurisdictional case studies in Riau and Kalimantan, where multi-stakeholder collaboration successfully enhanced smallholders' access to certified markets. Second, institutional strengthening and governance play a pivotal role in ensuring the effective implementation of policies. The involvement of both local and national institutions is critical for coordinating diverse programs, overseeing regulatory enforcement, and ensuring the engagement of all relevant stakeholders (Ostrom, 2015; North, 1990). Governance fragmentation between central and regional governments, as well as certification bodies, must be addressed through policy harmonization and enhanced institutional capacity. Third, the significance of data and traceability within the supply chain is paramount. Transparent monitoring and reporting systems constitute a fundamental requirement for complying with international standards and maintaining the credibility of Indonesian palm oil in global markets (Benedict et al., 2024; Trase, 2024). The development of digital technologies for land monitoring and cross-sector data integration can enhance traceability systems and facilitate certification processes.

Fourth, social innovation and the strengthening of local social capital are essential components for fostering resilience within the palm oil sector against external pressures and regulatory shifts (Baka et al., 2024; Mulyasari et al., 2023). The active involvement of local communities, farmer cooperatives, and grassroots actors enhances institutional embeddedness and collective capacity to adapt. Initiatives such as cooperative strengthening, technical training, and access to finance have been empirically demonstrated to improve smallholder participation in sustainability schemes.

Fifth, multi-stakeholder collaboration constitutes a critical prerequisite for the successful transformation of the palm oil sector. Synergistic interactions among government agencies, private enterprises, civil society, and international actors are essential to achieve ambitious sustainability targets (Bahruddin et al., 2024; Astari et al., 2025). Jurisdictional approaches and cross-actor dialogue forums serve to enhance coordination, build trust, and accelerate the adoption of sustainable practices.

Collectively, the public policy lessons derived from Indonesia's palm oil sector underscore the critical importance of adaptive, evidence-based, and context-sensitive policy design that responds effectively to both local and global dynamics. This experience provides a valuable reference for other countries facing similar trade-offs between economic growth and environmental sustainability, while also fostering policy innovation in other strategic commodity sectors.

Implications and Recommendations

The analysis of growth dynamics, environmental and social impacts, and policy implementation in Indonesia's palm oil sector indicates that the transition toward sustainability is a complex and multidimensional process. The findings carry significant implications for policymakers, industry actors, and civil society stakeholders seeking to promote positive transformations within this strategic commodity sector.

First, the necessity for adaptive and integrative public policies. Indonesia's experience demonstrates that single-policy approaches are insufficient to address the complex challenges in the palm oil sector. The integration of regulatory instruments, economic incentives, social innovation, and cross-sectoral collaborative approaches is essential for achieving sustainability. Policymakers should continuously strengthen the harmonization between national standards, such as the Indonesian Sustainable Palm Oil (ISPO), and international frameworks, including the Roundtable on Sustainable Palm Oil (RSPO) and the European Union Deforestation Regulation (EUDR), to ensure that Indonesian palm oil remains competitive in global markets while meeting sustainability requirements.

Second, strengthening the capacities of smallholders and local institutions. Smallholders constitute a pivotal segment of the palm oil supply chain, yet they face significant constraints in terms of technology, capital, and market access. Key recommendations include the provision of technical training, enhanced access to financing, and facilitation of certification processes to enable smallholders to actively participate in premium markets and sustainability programs. Strengthening cooperatives and farmer organizations is also essential to enhance bargaining power and competitiveness within the sector.

Third, the development of technology-based traceability and monitoring systems. Transparent reporting and monitoring systems are critical to ensuring compliance with sustainability standards and preventing illegal practices such as deforestation and peatland conversion. Both government and industry stakeholders should invest in digital technologies, including land-monitoring applications and cross-sector data integration, to strengthen traceability mechanisms and enhance supply chain transparency.

Fourth, multi-stakeholder collaboration and jurisdictional approaches. Synergies among government authorities, private sector actors, civil society, and international communities are essential to addressing governance fragmentation and accelerating the adoption of sustainable practices. Successful jurisdictional approaches implemented in certain regions can be replicated and scaled to other areas, with adaptations to local contexts and community needs.

Fifth, regular policy evaluation and adaptive adjustment. The dynamics of global markets, evolving international regulations, and technological developments necessitate responsive and flexible public policies. The government should conduct periodic assessments of policy effectiveness and facilitate participatory platforms that enable engagement of all relevant stakeholders in decision-making processes.

Collectively, these recommendations underscore that the sustainability of Indonesia's palm oil sector can only be achieved through adaptive, evidence-based, and collaborative public policies. Indonesia's experience provides valuable lessons for other countries confronting similar trade-offs between economic growth and environmental preservation, and it may serve to inform policy innovation in other strategic commodity sectors.

This study acknowledges several limitations that should be considered when interpreting the findings and policy recommendations. Firstly, the analysis primarily relies on literature reviews, policy documents, and publicly available secondary data. No primary data were collected through field surveys, in-depth interviews, or direct observations, which renders the findings largely descriptive and analytical in nature.

Secondly, limited access to up-to-date and verified data, particularly concerning smallholder statistics, deforestation trends, and policy implementation at the local level, may affect the comprehensiveness of the analysis. Some of the data utilized were derived from heterogeneous sources, which could result in variations in methodology and reporting scope.

Thirdly, this study does not provide an in-depth assessment of the impacts of recent policies, such as the European Union Deforestation Regulation (EUDR), on domestic supply chains and the livelihoods of smallholders in Indonesia. Additionally, digital innovations for monitoring and traceability continue to face challenges in adoption and cross-sectoral data integration.

Fourthly, the analysis primarily emphasizes the synthesis of literature and policy documents, and thus does not fully capture the socio-economic and environmental dynamics occurring in situ. Consequently, further empirical studies are required to provide a more comprehensive and nuanced understanding of the sector.

Future research is essential to advance a nuanced understanding of policy dynamics and their implications within Indonesia's palm oil sector. Empirical field studies incorporating direct interviews with smallholders, industry stakeholders, and local authorities are necessary to capture on-the-ground realities of policy implementation. Additionally, rigorous analysis of emerging regulatory frameworks, such as the European Union Deforestation Regulation (EUDR), is required to assess their impacts on domestic supply chains, market integration, and smallholder welfare. The strategic development and evaluation of digital technologies for land monitoring, traceability, and sustainability reporting offer significant potential to enhance transparency and governance effectiveness. Multidisciplinary investigations that integrate social, economic, environmental, and technological dimensions will provide critical insights to facilitate the sector's transition toward more inclusive, resilient, and sustainable practices

CONCLUSION

The Indonesian palm oil industry has experienced rapid expansion, contributing substantially to national economic growth, employment generation, and rural development. However, this expansion has also generated complex environmental and social challenges, including deforestation, peatland degradation, land conflicts, and disparities in smallholder welfare.

The analysis presented in this study indicates that adaptive, integrative, and collaborative public policies are essential to reconcile economic growth with environmental sustainability. Strengthening smallholder capacities, developing robust traceability systems, and harmonizing national and international standards constitute critical mechanisms for facilitating the transformation of the Indonesian palm oil industry toward more sustainable and inclusive practices.

A key policy lesson from the Indonesian experience is the necessity of policy integration (policy mix), institutional strengthening, social innovation, and multi-stakeholder collaboration to address the complex challenges encountered. Jurisdictional approaches and active engagement of local communities have been demonstrated to be effective in accelerating the adoption of sustainable practices at the field level.

Future efforts should prioritize continuous innovation and collaboration among government authorities, industry stakeholders, and civil society to reinforce the sustainability of the Indonesian palm oil sector. Systematic policy evaluation, enhancement of institutional capacity, and the adoption of digital technologies are critical determinants for ensuring the successful transformation of the industry, maintaining its competitiveness, inclusivity, and global resilience.

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