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LITERATURE MAPPING AND RESEARCH TRENDS ON SMALLHOLDER OIL PALM REPLANTING

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ABSTRACT

Oil palm replanting is critical for maintaining yields, improving farmer livelihoods, and reducing expansion to forested areas. Indonesia's smallholder farmers manage a large proportion of the national plantations but face declining productivity due to aging trees and substantial constraints in replanting programs. This study presents a systematic literature review of research published between 2015 and 2024 on smallholder oil palm replanting in Indonesia. Using PRISMA-based screening, this study applied Open Knowledge Maps and VOSviewer to examine research trends, thematic clusters, and knowledge gaps. The analysis identified five dominant themes: environmental impacts, biomass economic valuation, corporate farming schemes, institutional arrangements, and community-driven initiatives. Environmental studies focus on biodiversity and greenhouse gas emissions, whereas economic research examines subsidy effectiveness and productivity. Institutional analyses highlight policy frameworks and extension services, while community-oriented research explores farmer participation, collective action, and risk preferences. Despite increasing scholarly attention, major gaps remain in understanding replanting profitability, behavioral decision-making under risk, effective support mechanisms, and integrated sustainability dimensions. This study provides a comprehensive research map and outlines priorities for strengthening sustainable replanting strategies for Indonesian smallholders.

INTRODUCTION

The global oil palm supply chain relies significantly on the participation of smallholder farmers, who cultivate approximately 30% of the world's oil palm plantation area (de Vos et al., 2023). In Indonesia, smallholders' involvement is even more substantial, managing 6.3 million hectares or 41% of the nation's 15.3 million hectares (Dirjenbun, 2021), thus creating job opportunities and providing the primary household income (Syahza, 2005; Rist et al., 2010; Ruml et al., 2022). Smallholding farmers have significant land ownership for palm oil, underscoring their potential contribution to national palm oil production, reducing poverty, improving, and participating in the national foreign exchange earnings (Ruml et al., 2022).

Despite this, the proportion of smallholding palm oil in national production only amounts to 27%-38% (Raharja et al., 2020) due to the relatively low productivity. Dirjenbun (2021) data indicate that the average productivity of smallholders annualy is 2.8 tons per hectare, compared to 3.7 tons for private and 3.8 tons for state-owned plantations. The contributing factors to this gap include the use of non-superior planting material, inadequate maintenance practices, and a high number of damaged trees (Hidayati et al., 2014) or old, non-economic trees (Mariyah et al., 2018; Candra et al., 2021). It is important to note that smallholding lower productivity does not equal poor dedication of the farmers, but the consequences of systemic limitations in access to quality inputs, modern farming techniques, and financial resources for crucial investments, such as replanting. This challenge must be addressed to unlock the full potential of smallholder contributions to the palm oil industry, which eventually optimizes the sector's overall performance and ensure equitable benefits for all stakeholders.

Over time, oil palm plantations loses productivity and economic viability, so it requires replanting, especially for smallholdings in Indonesia. Replanting involves replacing old, damaged, and unproductive trees with superior seedlings to enhance productivity and ensure long-term environmental and economic sustainability (Qaim et al., 2020; Tabe-Ojong et al., 2023). Replanting can sustain high production on existing land and mitigate deforestation by reducing the pressure to clear new areas (Zhao et al., 2023; Wicke et al., 2011). Rejuvenated superior seedlings and superior genetic materials used for replanting result in a higher productivity. By extensions, farmers can restore their yield, earn double revenue, strengthen income security, and secure the long-term sustainability of their palm oil plantation. Therefore, it is essential to ensure the availability of high-quality, disease-resistant seedlings and the provision of technical assistance and training in modern cultivation practices to maximize the success of replanting efforts.

Timely and effective replanting programs are essential but smallholding farmers faces considerable hurdles in the implemenatation. Limited access to credit and financial support, input materials, and essential knowledge stand in farmers' way to start, maintain, and follow up replanting programs (Petri et al., 2024). When replanting seems unlikely, farmers may resort to land expansion which, unfortunately, risks the environmental degradation. Meanwhile, delayed replanting leads to the accumulation of old trees, increase in production costs for a sudden large-scale replanting process and materials, reduced palm oil output and export revenue, and potential income decline for farming households (Wahid & Simeh, 2010). This

broader economic implication affects not only smallholder livelihoods but also national production and exports. Therefore, facilitating smallholders' access to replanting resources and knowledge is a strategic investment in the future resilience and sustainability of the palm oil industry.

This article reviews and analyzes research on smallholder oil palm replanting over the last decade. We address the following research question: "What outcomes of smallholder oil palm replanting remain under-researched, particularly regarding economic viability, profitability, sustainability impacts, and livelihood effects?" To address this research question, this study pursues five analytical objectives: (1) to systematically search and map the literature on smallholder replanting from to 2015-2024, (2) to categorize studies by outcome type (economic, environmental, social, and livelihood), (3) to assess research intensity and evidence quality for each outcome dimension, (4) to identify geographic and contextual gaps in evidence, and (5) to synthesize findings to establish priorities for future research.

This research summarizes past studies and highlights emerging trends to identify research gaps and understand the current state of the art. Utilizing mapping and visualization methods in Open Knowledge Map (OKM) and VOS Viewer (VV), we use OKM to visualize keyword-based clusters from BASE and PubMed metadata, and VOS viewer to get bibliometric visualization using SCOPUS and ScienceDirect metadata. Both visualizations reveal the relationships between subfields, publication trends, and the density of research within each subtopic, reflecting the intensity of research on smallholder palm oil replanting.

This systematic literature review contributes to the field in several ways. First, it provides a comprehensive map of the current evidence base on smallholder replanting outcomes, revealing which dimensions are well researched and which remain understudied. Second, by explicitly identifying research gaps, it establishes clear priorities for future inquiry—priorities that are grounded in evidence rather than assumptions. Third, this review translates research findings into actionable insights for policymakers and development practitioners designing replanting-support programs. Finally, by synthesizing evidence across economic, environmental, and social dimensions, this review promotes a more integrated understanding of replanting sustainability, moving beyond single-dimension analyses to holistic assessments. Given that replanting decisions involve significant financial risk for smallholders and have implications for national food security, rural livelihoods, and environmental sustainability, evidence-based understanding of actual replanting outcomes is not merely academic but essential for practical policy and program design.

RESEARCH METHOD

This study employed a research methodology that combined the Open Knowledge Map (OKM) tool with Vos Viewer (VV). This approach follows the stages outlined in Figure 1, adapting a method developed by Marisa et al. (2022) with a slight modification.
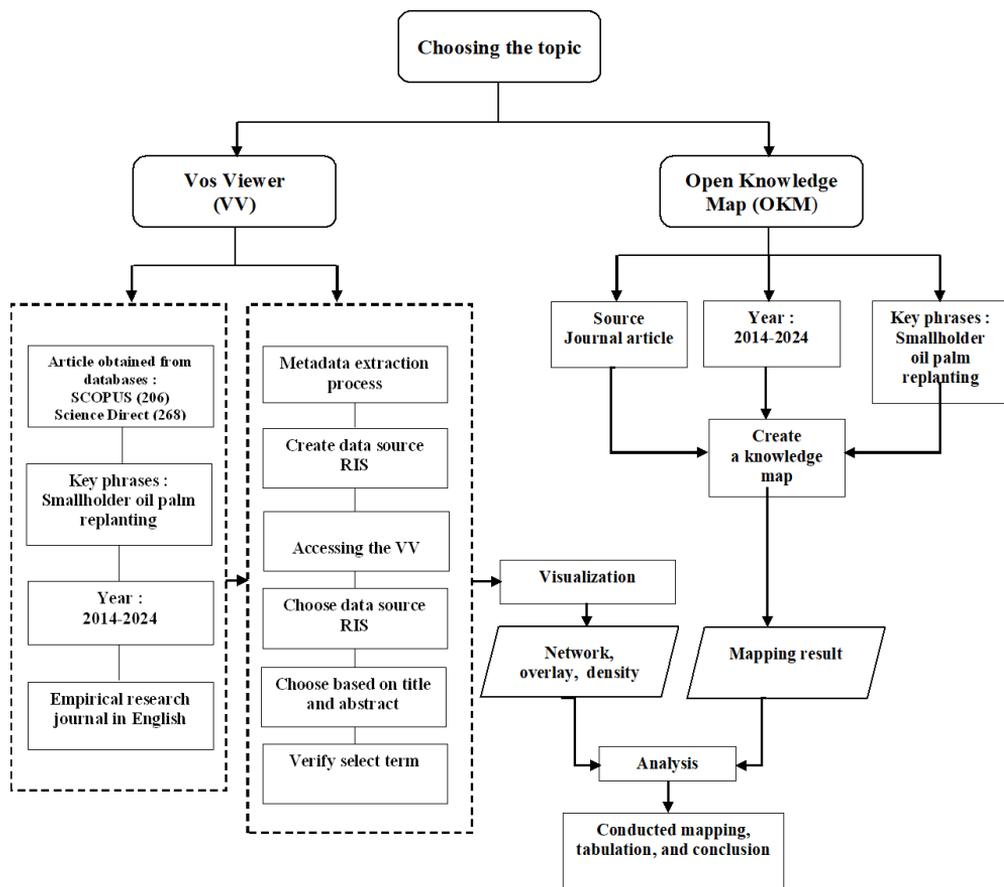
Figure 1.
Research Workflow for Systematic Literature Mapping

The Systematic Literature Review (SLR) methodology applied in this study is illustrated in Figure 2, with the following procedures:

1. Determine the topic to be analysed by selecting relevant keywords. Automatic search on the SCOPUS database was conducted on October 1, 2024 using a combination of keywords with Boolean techniques: TITLE-ABS-KEY ("oil palm AND replanting"). The keywords used in the Science Direct database are "oil palm AND replanting AND smallholders".

2. Run the analysis in Vos Viewer, starting from opening previously extracted metadata file in RIS format. At this stage, settings were put up to extract keywords from the titles and abstracts. This step managed to select the most relevant topic terms and 21 suitable articles

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┌──────────────────────────┐
│   Article obtained from  │
│  databases SCOPUS(206)   │
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│   Relevance of the title │──▶│ • Not empirical studies (38)          │
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│ relevance based on full  │   │ replanting and smallholder (61)      │
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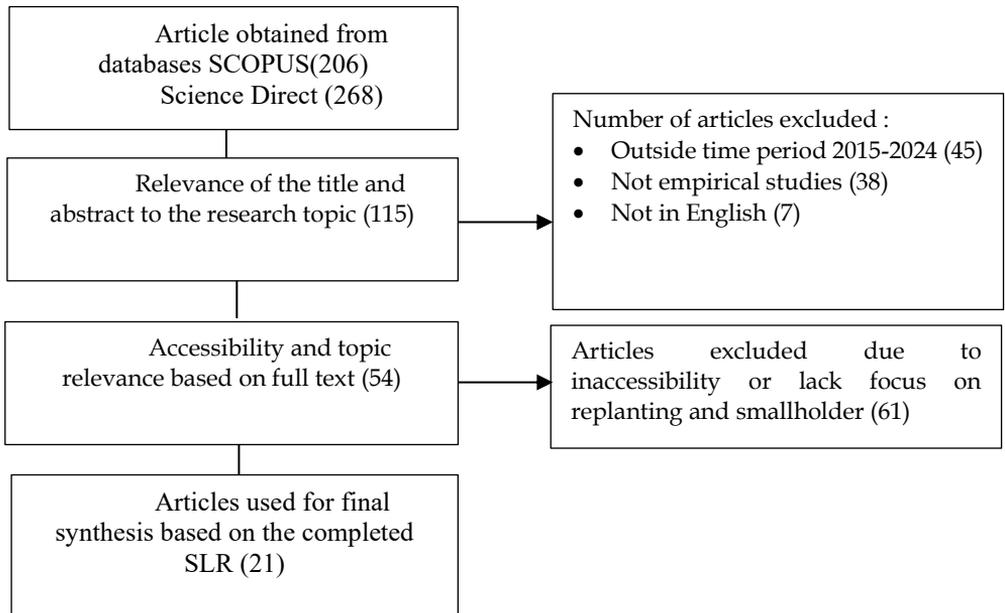
Figure 2.
Screening process of SCOPUS and Science Direct databases

3. Process the data to generate three visualisations: network visualisation to map connections within the research topic, overlay visualisation to show how research has evolved, and density visualisation to highlight the most frequently discussed topics.

4. Run the metadata analysis using the Open Knowledge Map (OKM) tool. We started by specifying the source of the metadata, the time frame of interest, and relevant keywords. Subsequently, data were processed to generate cluster visualisations based on the metadata mapping.

RESULT AND DISCUSSION

The OKM analysis revealed several key research areas related to smallholder oil palm replanting and clustered them into five distinct groups.

Figure 3.
Visualisation using Open Knowledge Map (OKM)

The literature map illustrates that the research foci of smallholder oil palm replanting encompass the environmental impacts, the role of corporations and institutions, and economic aspects. It suggests a multidisciplinary approach to understanding this complex issue.

Based on the mapping results from OKM, we identified five, non-intersecting research clusters related to smallholder oil palm replanting as presented in Table 1 below.

Table 1.   OKM Cluster Data Analysis

Cluster	Item	Number of Sources
Cluster 1	Environmental science	1
Cluster 2	Economic value of oil palm biomass	2
Cluster 3	Corporate Farming	2
Cluster 4	Institutional	1
Cluster 5	Community oil palm replanting program	10

Source: Open Knowledge Map (OKM)

The mapping outcomes of the OKM exploration show that research on oil palm replanting encompasses several key areas: 1) Community-driven replanting initiatives, which include the impact of government support on oil palm replanting; 2) Environmental impact assessments investigating the ecological consequences of replanting, such as biodiversity changes and environmental sustainability; 3) The role of businesses and cooperatives in supporting smallholders and promoting sustainable replanting practices; 4) The importance of policies, regulations, and institutional frameworks in facilitating successful replanting and mitigating post-replanting risks; and 5) The economic benefits of replanting, such as increased productivity, added value from palm oil products, and the potential for biomass and bioenergy from old palms.

The Vos viewer network visualisation data (Figure 4) shows the relationships among research topics on oil palm replanting by smallholders. The themes are interconnected with different node colours and sizes representing the frequency of occurrence and the relationship between keywords. In this visualisation, three main clusters are identified based on color.
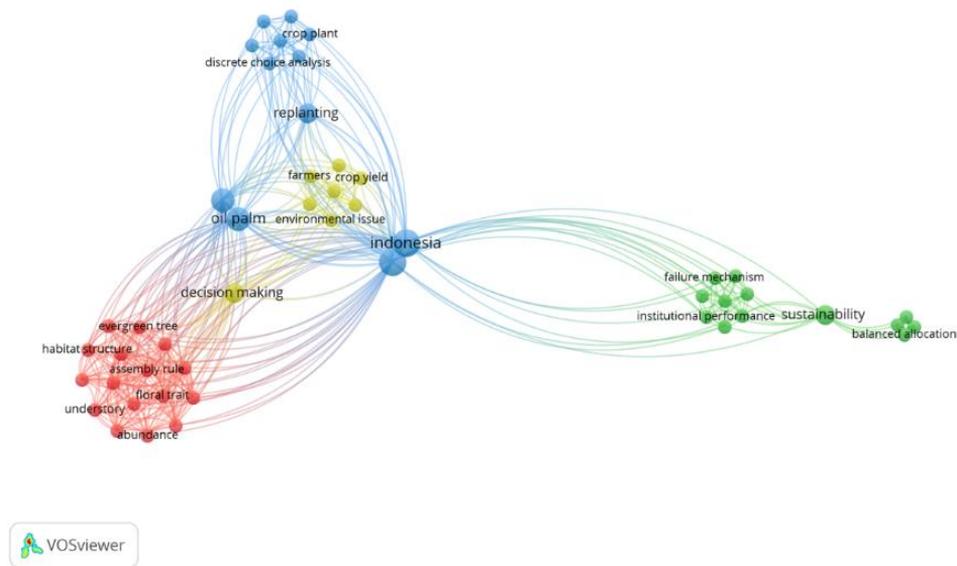

Figure 4.
Research Topics: Network Visualisation

The blue cluster, associated with Oil Palm and Replanting, focuses on oil palm replanting in Indonesia, highlights the environmental impacts, and explores topics like farmers' crop yields and decision-making processes. The green cluster, related to Institutional and Sustainability, emphasises the role of institutions and sustainable practices in oil palm replanting, including research on institutional performance and how failures affect smallholder support. Lastly, the red cluster focuses on ecology and biodiversity, delving into the ecological impacts of replanting and examining habitat structure, and biodiversity vegetation within oil palm plantations.

Vos viewer overlay visualisation (Figure 5) shows the color-coded evolution of oil palm replanting research over the past 10 years. Blue represents older research and yellow/green is for the newer topics.
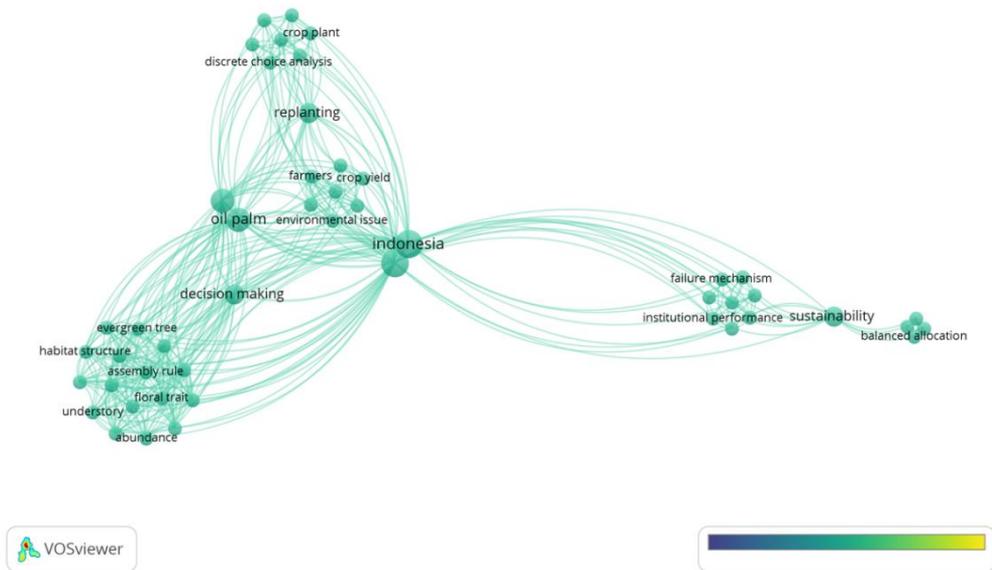

Figure 5.
Overlay visualization

Based on Figure 5, the early research on oil palm replanting primarily emphasised ecological aspects, such as habitat structure and biodiversity. Then, sustainability issue emerges as the new foci of the recent research, highlighting sustainability, institutional performance, and the impact of institutional failures on smallholders. Recent studies also underscore the interconnectedness of sustainability with environmental issues and the farmers' decision-making process.

In Figure 6, density visualization captures the intensity of research on smallholder oil palm replanting in the past decade. Yellow colour indicates a high density or frequency whereas green and blue colours indicate lower density.
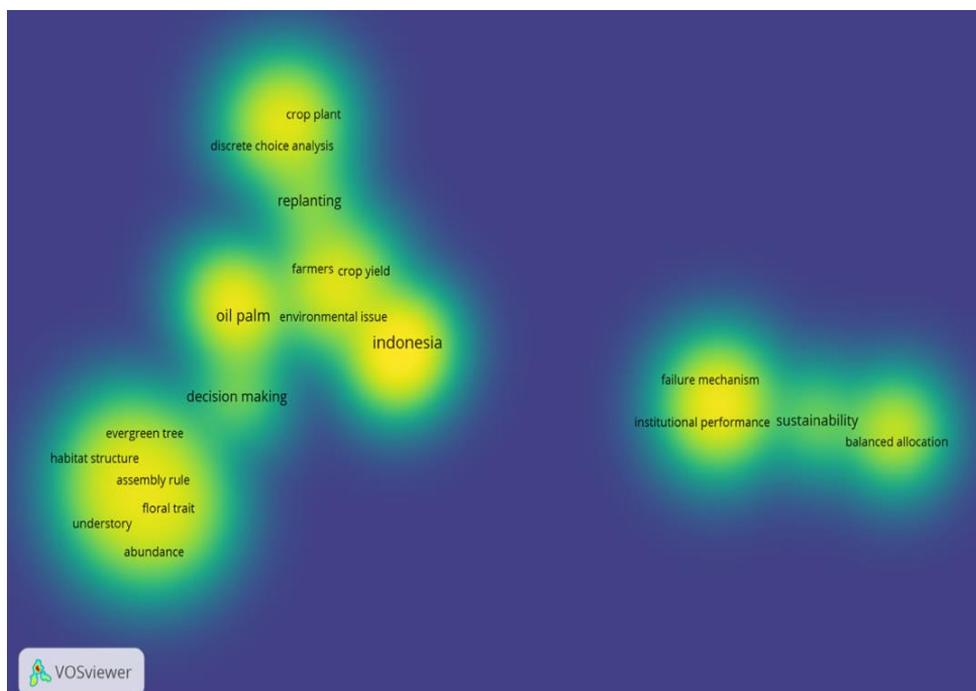
Figure 6.
Density visualisation

Based on Figure 6, the core cluster of key research areas in smallholder oil palm replanting in Indonesia is environmental impacts, with "Indonesia" and "environmental issues" prominent. Farmers' decisions and their role in yields gain traction in many investigations, utilising methods like discrete choice analysis. The green cluster highlights the importance of ecology and biodiversity, particularly habitat structure and understory vegetation. Another cluster emerges, focusing on sustainability, institutional performance, and the role of institutions in supporting smallholder replanting.

Final Synthesis

The selected articles specifically focus on research that discusses smallholder farmers and the oil palm replanting program. Table 2 shows studies included and discussed in detail in the final summary of this research.

Table 2.   Selected Articles for Final Synthesis

Article Title	Authors
Replanting and Sustainability	
Replanting unproductive palm oil with smallholder plantations can help achieve sustainable practice.	(Fosch et al., 2023)
Replanting and yield increase strategies for alleviating the potential decline in palm oil production in Indonesia.	(Zhao et al., 2023)

Article Title	Authors
Collective action, replanting and resilience. Key lessons from 40 years of smallholder oil palm cultivation in the Ophir plantation, Indonesia	(Jelsma et al., 2017)
Smallholders' preferred attributes in a subsidy program for replanting overaged oil palm plantations in Indonesia.	(Hendrawan & Musshoff 2024)
Optimization of crude palm oil fund to support smallholder oil palm replanting in reducing deforestation in Indonesia.	(Nurfatriani et al., 2019)

Environmental and Biodiversity Impact of Replanting

Article Title	Authors
Large-scale industrial plantations are more likely than smallholdings to threaten biodiversity from oil palm replanting spatial disturbances.	(Azhar et al., 2023)
Effects of replanting and retention of mature oil palm riparian buffers on ecosystem functioning in oil palm plantations.	(Woodham et al., 2019)
Replanting reduces frog diversity in oil palm	(Kurz et al., 2016)
The dynamic of carbon dioxide (CO2) emission and land coverage on intercropping system on oil palm replanting area.	(Mayandi, 2024)
Replanting of first-cycle oil palm results in a second wave of biodiversity loss.	(Ashton-Butt et al., 2019)

Economic and Financial Strategies

Article Title	Authors
improving indonesia's palm oil sustainability through financing: a study on disconnects and potential policy solutions.	(Wahid et al., 2024)
Sustainable investment strategies in the palm oil industry in Indonesia.	(Yuslaini et al., 2023)
The linkages and impact of plantation based sectors on economy and poverty in Jambi Province, Indonesia: Miyazawa's Input-Ouput Model.	(Hardiwan et al., 2019)
Optimization of palm oil plantation revitalization in North Sumatera Indonesia.	(Hidayati et al., 2015)
Maximizing crude palm oil production in Malaysia: A search for an optimal policy using system dynamics and genetic algorithm approach.	(Abidin et al., 2018)
The role of farm household saving for oil palm replanting at Paser Regency, East Kalimantan.	(Mariyah et al., 2018)
Optimization of crude palm oil fund to support smallholder oil palm replanting in reducing deforestation in Indonesia.	(Nurfatriani et al., 2019)

Article Title	Authors
Circular Economy and Biomass Utilization	
Circular bio economy in palm oil industry: current practices and future perspectives.	(Cheah et al., 2023)
A review on extraction processes of lignocellulosic chemicals from oil palm biomass.	(Noorshamsiana et al., 2017)
Dynamic System and Policy Models	
Palm oil-based biodiesel industry sustainability model using dynamic systems to balance food, energy, and export allocations.	(Mayandi, 2024)
Institutional development in the supply chain system of oil palm agroindustry in South Kalimantan.	(Heryani et al., 2022)
Palm oil plantation revitalisation model for the agroindustry development.	(Hidayati et al., 2018)

Areas for Future Research in Smallholder Oil Palm Replanting

Based on the final synthesis, further investigation can focus on some research gaps, including the economic impact of replanting on smallholder households. Existing studies largely focus on environmental sustainability and institutional arrangements (e.g., Fosch et al., 2023; Nurfatriani et al., 2019) whereas empirical analysis of how replanting affects household income, consumption, and overall well-being remains understudied (Mariyah et al., 2018). The current literature lacks understanding of both short-term income losses and long-term livelihood strategies following replanting.

Another important area is farmers' decision-making process when facing economic uncertainty. While research has predominanty examined farmer participation and preferences in replanting programs (Hendrawan & Musshoff, 2024), only limited evidence has reported in-depth analysis of behavioural responses to production and price risks, liquidity constraints, and uncertainty. Based on this gap, future studies can direct their attention to the risk perception and time preferences, and their influence on farmers' replanting decisions.

Furthermore, while the role of institutions is recognised (Raharja et al., 2020; Heryani et al., 2022), there lack of research on how farmers respond to institutional support programs and how their behaviour is influenced by government policies and interventions. This includes farmers' use of government incentives, the impacts of technical assistance, and psychological and social barriers of farmers' participation in replanting programs.

Additionally, while the literature focuses on institutional and corporate aspects, research on community-based economic models for supporting smallholder oil palm replanting remain underdeveloped. Studies exploring cooperatives, collective action, or community-managed partnerships are relatively few (Jelsma et al., 2017), despite their potential to improve access to capital, markets, and risk-sharing mechanisms.

Finally, sustainability dominates the current body of research on oil palm replanting, but mostly focuses on the environmental aspects (Azhar et al., 2023; Ashton-Butt et al., 2019). Future research can integrate economic and social

dimensions to better understand the depth of sustainability. This necessitates the development of sustainability indicators that assess the socio-economic impact on smallholder communities, including job creation, skill development, and local economic equity.

CONCLUSION

Research on smallholder oil palm replanting are generally analytical, examining the interplay between environmental, institutional, and economic dimensions. Replanting programs are crucial for sustaining productivity, reducing deforestation, and ensuring long-term financial benefits for smallholder farmers. However, financial challenge, decision-making under uncertainty, and institutional support systems remain significant barriers to successful implementation.

Environmental studies predominantly focus on the impact of replanting on biodiversity and carbon dynamics, while economic research emphasises the optimisation of replanting programs and the role of subsidies and incentives. While institutional studies underscore the critical role of government policies and corporate partnerships in fostering sustainable practices, it leaves a considerable gap in the interconnections between sustainability, economic, social, and environmental, and their collective impact on smallholder livelihoods.

AUTHOR CONTRIBUTION STATEMENT

[Author 1]: Conceptualisation and research design of the literature mapping study on smallholder oil palm replanting; literature search; data extraction; data curation and bibliometric dataset preparation; visualisation of mapping results and research trends; original manuscript draft preparation; manuscript review, revision, and final approval. [Author 2]: Conceptualisation and research design of the literature mapping study; data curation and bibliometric dataset preparation; supervision and methodological guidance; manuscript review, revision, and final approval. [Author 3]: Conceptualisation and research design of the literature mapping study; data curation and bibliometric dataset preparation; supervision and methodological guidance; manuscript review, revision, and final approval. [Author 4]: Conceptualisation and research design of the literature mapping study; data curation and bibliometric dataset preparation; supervision and methodological guidance; manuscript review, revision, and final approval.

DECLARATION OF COMPETING INTEREST

The authors declare that there are no financial, personal, or professional relationships that could be construed as a potential conflict of interest in relation to this study.

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ETHIC STATEMENT

This study is based exclusively on a review and bibliometric analysis of published literature and does not involve human participants, personal data, or experimental subjects. Therefore, ethical approval was not required. All data used in this study were obtained from publicly accessible academic databases and were analyzed in accordance with standard scholarly and ethical research practices.

REFERENCES

Abidin, N. Z., Applanaidu, S. D. & Faeid, M. Z. M. (2018). Maximising Crude Palm Oil Production In Malaysia: A Search For An Optimal Policy Using System Dynamics And Genetic Algorithm Approach. *Journal of Social Sciences Research,* Special Issue, pp 878–884. doi: 10.32861/jssr.spi6.878.88/

Ashton-Butt, A., S. Willcock, D. Purnomo, A. A. K. Aryawan, R. Wahyuningsih, M. Naim, G. M. Poppy, J. P. Caliman, K. S. H. Peh, & J. L. Snaddon. (2019). Replanting Of First-Cycle Oil Palm Results In A Second Wave Of Biodiversity Loss. *Ecology and Evolution*, 9(1), 6433–6443. doi: 10.1002/ece3.5218

Azhar, B., A. Oon, A. M. Lechner, A. Ashton-Butt, M. S. Yahya, & D. B. Lindenmayer. (2023). Large-Scale Industrial Plantations Are More Likely Than Smallholdings to Threaten Biodiversity From Oil Palm Replanting Spatial Disturbances. *Global Ecology and Conservation*, 45(1), 1-13. doi: 10.1016/j.gecco.2023.e02513

Candra, E., S. Hadi, N. Dewi, & R. S. Anggraini. (2021). Independent Oil Palm Smallholder Farmers; Household Income, Consumption, And Sustainability Challenges. *Jurnal Agribisnis,* 23(1), 101-115. doi: 10.31849/agr.v23i1.5410

Cheah, W. Y., R. P. Siti-Dina, S. T. K. Leng, A. C. Er, & P. L. Show. (2023). Circular Bioeconomy In Palm Oil Industry: Current Practices And Future Perspectives. *Journal of Environmental Technology and Innovation*, 30(1), 1-12. doi: 10.1016/j.eti.2023.103050

de Vos, R. E., L. Nurfalah, F. A. Tenorio, Y. L. Lim, J. P. Monzon, C. R. Donough, H. Sugianto, A. A. Dwiyahreni, N. L. Winarni, N. Mulani, G. Ramadhan, M. A. Imran, A. P. Tito, P. Sulistiawan, M. Khoirul, R. Farrasati, I. Pradiko, P. Grassini, & M. Slingerland. (2023). Shortening Harvest Interval, Reaping Benefits? A Study On Harvest Practices In Oil Palm Smallholder Farming Systems In Indonesia. *Agricultural Systems,* 130(1), 1-12. doi: 10.1016/j.landusepol.2023.106660

Direktoral Jenderal Perkebunan/Dirjenbun. (2021). *Statistik Perkebunan Non Unggulan Nasional 2020-2022.* Sekretariat Direktorat Jendral Perkebunan. Retrieved from https://ditjenbun.pertanian.go.id/?publikasi=buku-statistik perkebunan-non-unggulan-2020-2022

Fosch, A., G. Ferraz de Arruda, A. Aleta, A. Descals, D. Gaveau, C. Morgans, T. Santika, M. J. Struebig, E. Meijaard, & Y. Moreno. (2023). Replanting

Unproductive Palm Oil With Smallholder Plantations Can Help Achieve Sustainable Development Goals In Sumatra, Indonesia. *Communications Earth And Environment*, 20(1), 1-12. doi: 10.1038/s43247-023-01037-4

Hardiwan, D., A. Amir, J. Junaidi, & A. Delis. (2019). The Linkages and Impact of Plantation Based Sectors on Economy and Poverty in Jambi Province, Indonesia: Miyazawa's Input-Output Model. *Agricultural and Resource Economics,* 5(3), 5-19. doi: 10.51599/are.2019.05.03.01

Hendrawan, D., & O. Musshoff. (2024). Smallholders' Preferred Attributes In A Subsidy Program For Replanting Overaged Oil Palm Plantations In Indonesia. *Ecological Economics,* 224(1), 2-14. doi: 10.1016/j.ecolecon.2024.108278

Heryani, H., A. C., Legowo, N. R. Yanti, S. Raharja, T. Djatna, S. Martini, T. Baidawi, & I. Afrianto. (2022). Institutional Development In The Supply Chain System Of Oil Palm Agroindustry In South Kalimantan. *International Journal of Technology*, 13(3), 643–654. doi: 10.14716/ijtech.v13i3.4754

Hidayati, J., A. Suryani, dan A. M. Fauzi. (2015). Optimization of Palm Oil Plantation Revitalization In North Sumatra Indonesia. *International Journal On Advanced Science, Engineering and Information Technology,* 5(6), 460-468, doi: 10.18517/ijaseit.5.6

Hidayati, J., S. Sukardi, A. Suryani, A. M. Fauzi, & S. Sugiharto. (2018). Palm Oil Plantation Revitalization Model For The Agroindustry Development. *International Journal On Advanced Science, Engineering and Information Technology*, 8(2), 588-595. doi: 10.18517/ijaseit.8.2.4148

Hidayati, J., S. Sukardi, A. Suryani, S. Sugiharto, & A. M. Fauzi. (2014). Analysis Of Productivity Improvement In The Palm Oil Plantation Revitalisation of North Sumatra Using Analytic Network Process. *International Journal on Advanced Science, Engineering and Information Technology,* 4(3), 38-44, doi: 10.18517/ijaseit.4.3.392

Jelsma, I., M. Slingerland, K. E. Giller, & J. Bijman. (2017). Collective Action In A Smallholder Oil Palm Production System In Indonesia: The Key To Sustainable And Inclusive Smallholder Palm Oil? *Journal of Rural Studies,*54(1),198-210. doi: 10.1016/j.jrurstud.2017.06.005

Kurz, D. J., E. C. Turner, A. A. Aryawan, H. C. Barkley, J. P. Caliman, O. Konopik, S. Ps, & W. A. Foster. (2016). Replanting Reduces Frog Diversity In Oil Palm. *Biotropica,* 48(4), 483-490. doi: 10.1111/btp.12320

Marisa, F., A. R. Wardhani, W. Purnomowati, & A. L. Maukar. (2022). Pemetaan Dan Analisis Perkembangan Bidang Gamification Berbasis Metode Kombinasi Open Knowledge Map Dan Vos Viewer. *JIKO (Jurnal Informatika Dan Komputer)*, 6(2), 194-199. doi: 10.26798/jiko.v6i2.606

Mariyah, Y. Syaukat, S. Hartoyo, A. Fariyanti, & B. Krisnamurthi. (2018). The Role Of Farm Household Saving For Oil Palm Replanting At Paser Regency, East

Kalimantan. *International Journal Of Economics And Financial Issues: IJEFI*, 8(5), 124-130. Retrieved from https://www.econjournals.com/

Mayandi, Z. (2024). Palm Oil-Based Biodiesel Industry Sustainability Model Using Dynamic Systems To Balance Food, Energy, And Export Allocations. *Smart Agricultural Technology*, 7(1), 1-11. doi: 10.1016/j.atech.2024.100421

Noorshamsiana, A. W., A. O. Nur Eliyanti, I. Fatiha, & A. A. Astimar. (2017). A Review On Extraction Processes Of Lignocellulosic Chemicals From Oil Palm Biomass. *Journal of Oil Palm Research*, 29(4), 512-527. doi: 10.21894/jopr.2017.00016

Nurfatriani, F., Ramawati, G. K. Sari, & H. Komarudin. (2019). Optimisation of Crude Palm Oil Fund To Support Smallholder Oil Palm Replanting In Reducing Deforestation In Indonesia. *Sustainability (Switzerland),* 11(18), 1-16. doi: 10.3390/su11184914

Petri, H., D. Hendrawan, T. Bähr, O. Musshoff, M. Wollni, R. Asnawi, & H. Faust. (2024). Replanting Challenges Among Indonesian Oil Palm Smallholders: A Narrative Review. *Environment, Development And Sustainability*, 26(8), 19351-19367. doi: 10.1007/s10668-023-03527-z

Qaim, M., K. T. Sibhatu, H. Siregar, & I. Grass. (2020). Environmental, Economic, And Social Consequences Of The Oil Palm Boom. *Annual Review Of Resource Economics,* 12(1), 321-344. doi: 10.1146/annurev-resource-110119-024922

Raharja, S., Marimin, Machfud, P. Papilo, Safriyana, M. Y. Massijaya, M. Asrol, & M. A. Darmawan. (2020). Institutional Strengthening Model Of Oil Palm Independent Smallholders in Riau And Jambi Provinces, Indonesia. *Heliyon*, 6(5), 1-17, doi: 10.1016/j.heliyon.2020.e03875

Rist, L., L. Feintrenie, & P. Levang. (2010). The Livelihood Impacts Of Oil Palm: Smallholders In Indonesia. *Biodiversity and Conservation,* 19(4), 1009-1024, doi: 10.1007/s10531-010-9815-z

Ruml, A., D. Chrisendo, A. M. Iddrisu, A. A. Karakara, N. Nuryartono, E. Osabuohien, & J. Lay. (2022). Smallholders In Agro-Industrial Production: Lessons For Rural Development From A Comparative Analysis Of Ghana's And Indonesia's Oil Palm Sectors. *Land Use Policy,* 119(1), 1-14. doi: 10.1016/j.landusepol.2022.106196

Syahza, A. (2005). Dampak Pembangunan Perkebunan Kelapa Sawit Terhadap Multiplier Effect Ekonomi Pedesaan Di Daerah Riau. *Jurnal Ekonomi*, 10(3), 220-231. Retrieved from https://repository.unri.ac.id/

Tabe-Ojong, M., Alamsyah, Z., Sibhatu, K., (2023). Oil Palm Expansion, Food Security And Diets: Comparative Evidence From Cameroon And Indonesia. *Journal Of Cleaner Production,* 418(2) 1-11. doi: 10.1016/j.jclepro.2023.138085

Wahid, M. B. & Simeh, M. A. (2010). Accelerated Oil Palm Replanting : The Way Forward For A Sustainable And Competitive Industry. *Oil Palm Industry Economic Journal,* 10(2), pp. 29-38. Retrieved from https://palmoilis.mpob.gov.my/publications/OPIEJ/opiejv10n2-basri.pdf

Wahid, W. W. C., K. R. Aprillia, H. Herdiansyah, D. Ramatia, N. Setiawati, S. Subkhi, A. B. D. P. Swastika, N. Pranindita, & E. Rianawati. (2024). Improving

Indonesia's Palm Oil Sustainability Through Financing : A Study On Disconnects And Potential Policy Solutions. *Indonesian Journal Of International Law,* 21(5), 121-150. doi: 10.17304/IJIL.VOL21.5.1880

Wicke, B., R. Sikkema, V. Dornburg, & A. Faaij. (2011). Exploring Land Use Changes And The Role Of Palm Oil Production In Indonesia And Malaysia. *Land Use Policy,* 28(1), 193-206. doi: 10.1016/j.landusepol.2010.06.001

Woodham, C. R., A. A. K. Aryawan, S. H. Luke, P. Manning, J. P. Caliman, M. Naim, E. C. Turner, & E. M. Slade. (2019). Effects Of Replanting And Retention Of Mature Oil Palm Riparian Buffers On Ecosystem Functioning In Oil Palm Plantations. *Journal of Frontiers In Forests And Global Change.* 2(1), doi: 10.3389/ffgc.2019.00029

Yuslaini, N., R. Widya Setiabudi Sumadinata, M. Fedryansyah, A. Abdillah, A. L. Prianto, & D. Febriyanti. (2023). Sustainable Investment Strategies In The Palm Oil Industry In Indonesia. *Journal Of Infrastructure, Policy And Development,* 7(3), 1-21. doi: 10.24294/jipd.v7i3.2288

Zhao, J., A. Elmore, J. Lee, I. Numata, X. Zhang, & M. Cochrane. (2023). Replanting And Yield Increase Strategies For Alleviating The Potential Decline In Palm Oil Production In Indonesia. *Agricultural Systems,* 210(3), 1-9. doi: 10.1016/j.agsy.2023.103714