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RESEARCH ARTICLE
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Driving Force and Logical Framework Approach for Smallholder Oil Palm Farmers' Strategy of Land Clearing

Laras Andria Wardani [1,2]*, Tri Edhi Budhi Soesilo [1], Herdis Herdiansyah [1] and Evi Frimawaty [1]

[1]Department of Environmental Science, Graduate School of Sustainable Development (GSSD), University of Indonesia, Salemba DKI Jakarta, Indonesia
[2]Department of Environmental Engineering, Faculty of Engineering, University of Bhayangkara Jakarta Raya, Indonesia
*Corresponding author: laras.andria.wardani@dsn.ubharajaya.ac.id

ABSTRACT

In 2025, the area of oil palm plantations in Indonesia will reach 16.38 million ha, and has approached the carrying capacity limit of 18.15 million ha. Although the government had planned to impose a moratorium on oil palm plants (2018), new oil palm plantations by smallholders have grown significantly. Therefore, the study aims to identify the driving force and techniques of land clearing by smallholder oil palm farmers and analyse the strategy to delay carrying capacity threshold exceedance in smallholder oil palm plantations. The methods are FGD for stakeholders, NVivo and LFA. The results show that there are five driving factors: demographic, social, economic, political, and environmental. Economic factors are the most dominant driving factor. Based on stakeholder interview analysis, there are five LFA strategies to anticipate smallholder oil palm land clearing: (1) optimisation of old land improvements by local communities; (2) optimisation of communities to be able to obtain decent jobs; (3) diversification of palm oil plantation management to reduce the risk of falling palm oil prices, but can also improve the community's economy; (4) collaboration between the central government and village governments in regulating policies related to integrated smallholder oil palm plantations; (5) implementation of certification for environmental sustainability. The significance of this study lies in its comprehensive assessment of the driving factors and implementation of the five strategies, so land clearing can be significantly reduced, to delay carrying capacity threshold exceedance, and supporting sustainable land management and improving environmental quality.

Keywords: Driving Force, Land Clearing, Oil Palm, Smallholder, Strategies.

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INTRODUCTION

The increase in global palm oil consumption is accompanied by exponential growth in palm oil activities (Padfield et al., 2019). The fulfilment of the increasing need for palm oil will indirectly encourage the expansion of oil palm plantation areas. By 2050, around 8% to 22% of secondary forests and 21% to 54% of peatlands will be targeted for the expansion of world oil palm plantations (Xin et al., 2022). Therefore, to suppress the increasing clearing of oil palm plantations, this study identified drivers that influence Land Clearing Drivers for Smallholder Oil Palm Plantations. Identification was carried out using software called Vosviewer by limiting the year of publication of the article to 2014-2025. The results of the identification related to the research theme of land clearing drivers for smallholder oil palm plantations showed a grouping of articles and complex relationships for each keyword, can be seen in Fig. 1.

In Fig. 1 is a visualization of the keyword network of the Land Clearing Drivers for Smallholder Palm Oil Plantations theme, the results of which show the existence of a keyword network that is divided into five main groups and is interconnected. The five groups of driver keywords include demographics, social, politics, economy, and environment. Furthermore, the identification of the number of selected documents that are in accordance with the time analysis can be seen in Fig. 2.

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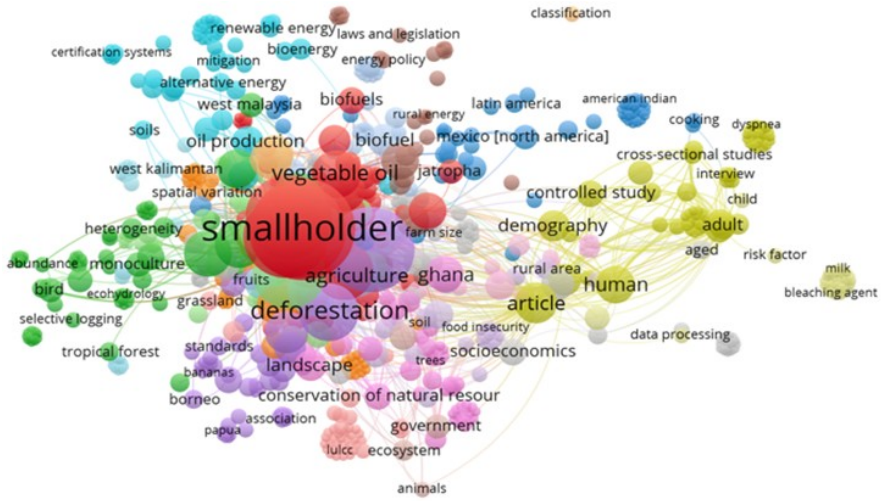

Fig. 1: Visualization of Keyword Network.

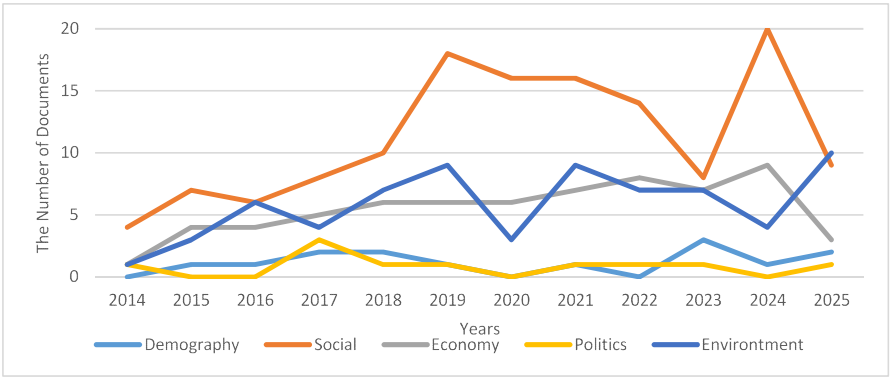

Fig. 2: The Number of Selected Research Documents with Keywords 'smallholder', 'oil palm', and 'drivers' (Demography, Social, Economy, Politics, and Environment).

Fig. 2 shows that there are 454 literature documents from 2014 to 2025, with the highest peak of documents occurring in 2019. This suggests that in 2019, academics began to care about smallholder palm oil to help reduce the impacts it produces. Based on Fig. 2, it can be seen that social factors are the most dominant drivers. Social drivers are also factor that initiate smallholder interest in palm oil commodities. Smallholder oil palm farmers admit that although direct financial income is relatively small, they can be motivators for other farmers to join as farmers (Apriani et al., 2020). This needs to be further proven with field data regarding the driving factors that most influence the land clearing of smallholder oil palm land. Currently, smallholders are also considered the main cause of oil palm land clearing problems (Maswadi et al., 2018). Smallholder oil palm land clearing activities that do not apply sustainable principles, if not handled properly immediately, will cause increasingly serious problems. Land clearing for oil palm plantations can cause widespread environmental damage, such as loss of biodiversity, reduced forest canopy, severe ecological degradation, water and air pollution, increased greenhouse gas emissions, and land subsidence that can exacerbate flood risks (Fulazzaky et al., 2022; Abideen et al., 2023; Darmadi et al., 2023; Gan et al., 2023). While oil palm plantations also have positive impacts through improved market conditions and employment, greed remains a dominant factor (Millán-Quijano & Pulgarín, 2023). There is a wealth of literature on the consequences of oil palm plantation expansion, with conflict and violence playing a significant role (Kuhnt, 2019). Most previous studies have identified violence as a trigger or driving factor in the decision to migrate, both within and between countries (Davenport et al., 2003; Engel & Ibáñez, 2007; Melander & Öberg, 2007). In other cases, palm oil producers exploit weak legal regimes to develop their plantations on vacant or abandoned land (Marin-Burgos, 2014). Palm oil exploitation is still not accompanied by adequate controls to protect land ownership rights, thus potentially leading to the seizure or forced displacement of local communities' land (Goebertus, 2008). Based on these statements, it can be concluded that the negative impacts of palm oil outweigh its benefits, and debate continues regarding its sustainability. Based on the results of Vosviewer mapping, several countries that have made significant contributions to the literature on land clearing drivers for smallholder palm oil plantations are Indonesia, Malaysia, United States, Germany, Netherlands, Australia, etc. Interesting fact that most articles discuss downstream issues such as environmental degradation, certification, biodiversity loss, habitat destruction, land use change, sustainability policy, and so on. Indonesia is the world's largest producer of palm oil (USDA-FAS, 2020). The expansion of oil palm areas in Indonesia is claimed to be the result of deforestation and land clearing, especially through forest burning (Listiningrum et al., 2021). In response to this, the President issued Instruction Number 8 of 2018 concerning the Postponement and Evaluation of Oil Palm Plantation Licensing and Increasing Oil Palm Plantation Productivity. The instruction aims to reduce the

negative impacts of unsustainable oil palm plantation expansion. However, since the moratorium policy was issued in 2018, the expansion of oil palm plantation areas in Indonesia has continued, namely 16,833,985 ha (BPS-Ststistic Indonesia, 2023), while the environmental carrying capacity is only around 18.15 million hectares. This indicates that land use for oil palm plantations is approaching the limits of its available carrying capacity, necessitating more sustainable management to prevent environmental capacity from being exceeded. The expansion of oil palm plantations by smallholders in Indonesia is growing rapidly and through unlawful forest clearing (Krishna et al., 2017; Nurfatriani et al., 2019; Nurrochmat et al., 2019). On the other hand, the development of oil palm plantations contributes significantly to improving the welfare of rural communities and national income (Krishna et al., 2017; Santika et al., 2019; Ayompe et al., 2023; Ahmad et al., 2023; Reich & Musshoff, 2025). This development is influenced by several driving factors: Demography, Social, Economy, Politics, and Environment. Therefore, the novelty of this research lies in the sustainability of Strategies to delay carrying capacity threshold exceedance in smallholder oil palm plantations due to the driving force. This research also focuses on determining what driving factors are most dominant in the field, thus contributing significantly to deforestation for oil palm plantations. This study aims to identify the occurrence of driving factors for the land clearing of oil palm plantations by the smallholder, and analyse the strategy to delay carrying capacity threshold exceedance in smallholder oil palm plantations.

MATERIALS & METHODS

The research location was conducted in Jambi, Indonesia (Fig. 3). Furthermore, the selection of stakeholders was narrowed down to areas in Indonesia that have experienced a massive increase in the area of oil palm plantations since the issuance of Presidential Instruction Number 8 of 2018. More specifically, research by Rosyidy and Frimawaty (2024) shows that smallholder oil palm plantations in the Jambi region play a significant role in increasing deforestation not only in Jambi Province but also throughout Indonesia.

The method in this study uses the Focus Group Discussion (FGD)s for stakeholders. FGDs were conducted to collect data from stakeholders consisting of community leaders, government, academics, industry, and NGOs. The number of FGD participants was 14 people, with the sample size determined using purposive sampling, who met the following criteria: having been involved in smallholder oil palm in Jambi Province, and having lived in the area for at least 25 years; being able to describe the study area; and being willing to be a data source. The FGD results were transcribed verbatim and analyzed using NVivo to capture all driving forces emerging from the field (open coding), and to organize nodes into thematic categories (axial code). Validation was carried out through triangulation of data sources. The data obtained were processed descriptively and validated using NVivo, and analysis using Logical Framework Analysis (LFA) to produce strategies that can reduce massive land clearing by smallholders. LFA is a modified method for analysing smallholder oil palm land clearing systems as a crucial step in planning. Compared to other tools that do not examine land clearing systems holistically and tend to force authorities to focus solely on their respective tasks, LFA offers a more effective framework. The LFA method is based on stakeholder analysis and generates a problem hierarchy to identify potential impacts. These impacts must be addressed immediately through a feasibility analysis of sustainable strategies. This method helps decision-makers understand the problem, its causes, and its root causes, allowing for more logical formulation of management strategies. Therefore, the use of LFA still requires further analysis to identify the root causes contributing to the problem, allowing for the development of feasible and scalable solutions or strategies.

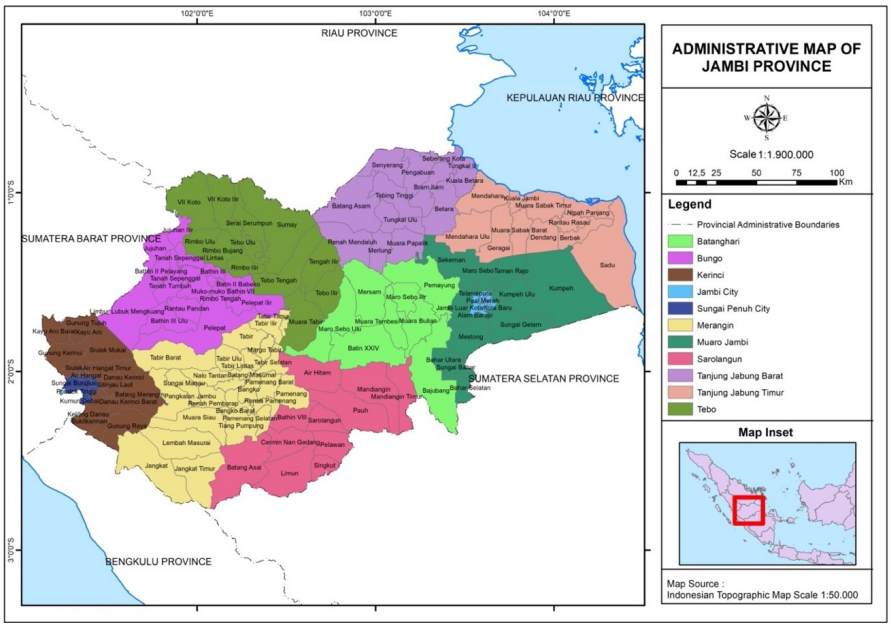

Fig. 3: Jambi Province, Indonesia (Geospatial Information Agency, 2025; modified).

RESULTS

The word cloud and Thematic Analysis Map of stakeholder results analysis using NVivo 12 can be seen in Fig. 4.

According to the literature, most documents discussing this topic emphasize social aspects as the primary issue (Xin et al., 2022; Nolos et al., 2023; Suroso et al., 2022; Wang et al., 2022; Ongolo & Krott, 2023; Berget et al., 2024; Petri et al., 2024; Pyone et al., 2024; Elon et al., 2025; Mangaza et al., 2025; Openg et al., 2025; Primadasa et al., 2025). However, the reality on the ground points differently. Interviews revealed that informants actually believe economic factors are far more dominant in influencing the dynamics. The discrepancy between the literature findings and the reality of the interviews emphasizes the need for a more in-depth review to bridge the gap between academic studies and factual conditions in the field. In addition, there was also one word that indicated a word that included the most dominant driving factor among other driving factors, namely the economy. This word can be considered to mean that the economic driving factor is the dominant driving factor so that it can open up oil palm plantations massively. In line with the economic driving factor, the land clearing of new oil palm plantations is considered capable of supporting the lives of the people so that local people compete to try to open new land. Therefore, a more in-depth analysis of the results of the driving force interviews from stakeholders is required, which can be seen in Fig. 5.

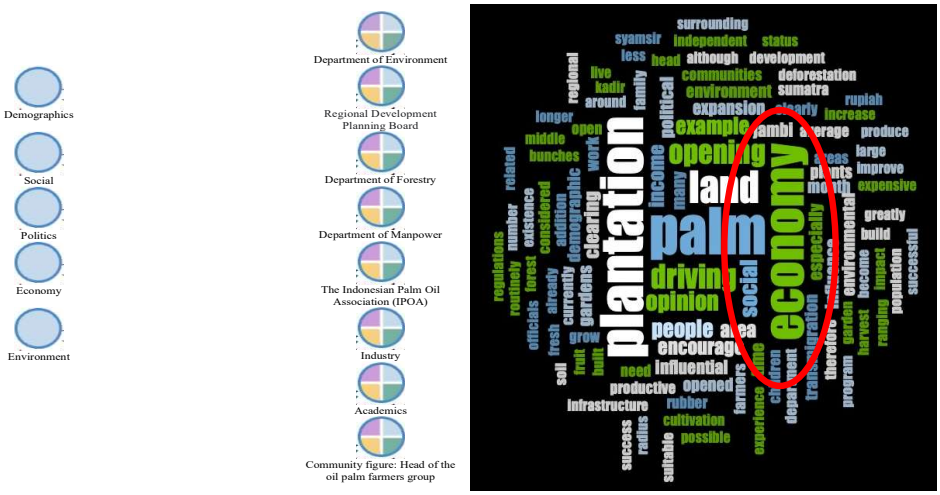

Fig. 4: Thematic Analysis Map and Word cloud for Driving Factors.

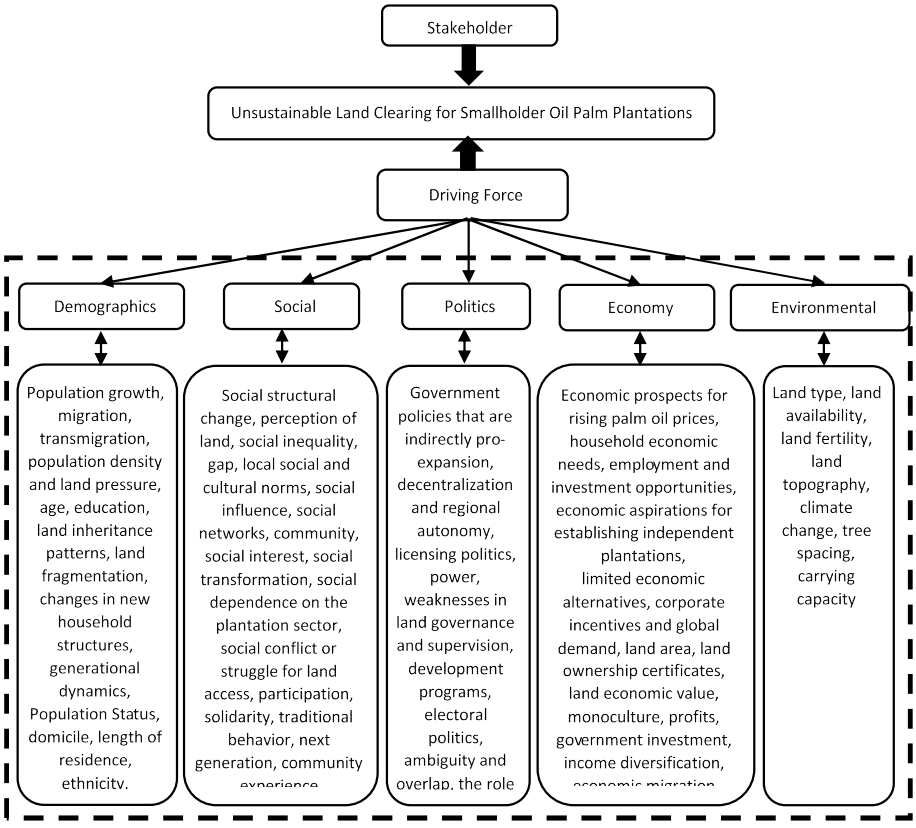

Fig. 5: Node grouping for driving force.

Based on the identification of the driving factors found, a strategy is needed to reduce the impacts that will occur from the clearing of oil palm plantations by using LFA. In the problem analysis section of the LFA method, a problem tree is used as a tool to identify and map the cause-and-effect relationships of various problems related to the research issue at hand. Problem issues are located at the bottom of the tree, identified as the root of the problem, while in the middle of the tree there is the core problem which is the main focus of the analysis, and at the top of the tree is depicted as the impact or consequence that arises as a result of the main problem. This problem analysis also plays an important role in helping to identify and differentiate various types of obstacles, especially in categorizing which are considered very urgent to be addressed immediately and which are the main ones. The root causes of each main problem for each driving factor are shown in Fig. 6.

In the problem tree analysis, it illustrates the cause-and-effect relationship that ultimately impacts the unsustainability of oil palm cultivation carried out by smallholders. Based on the problem tree, the main factors causing suboptimal land clearing for smallholder oil palm plantations are categorised into 5 main subsystems, namely: massive new land clearing (demographic subsystem), competition for land use (social subsystem), overlapping tasks and responsibilities (political subsystem), encroachment of oil palm monoculture (economic subsystem), and environmental transformation (environmental subsystem). Furthermore, five strategies categorised as shown in Fig. 7.

DISCUSSION

Based on the results, it was found that land clearing for smallholder oil palm plantations was influenced by various driving factors including demographic, social, economic, political and environmental subsystems and this

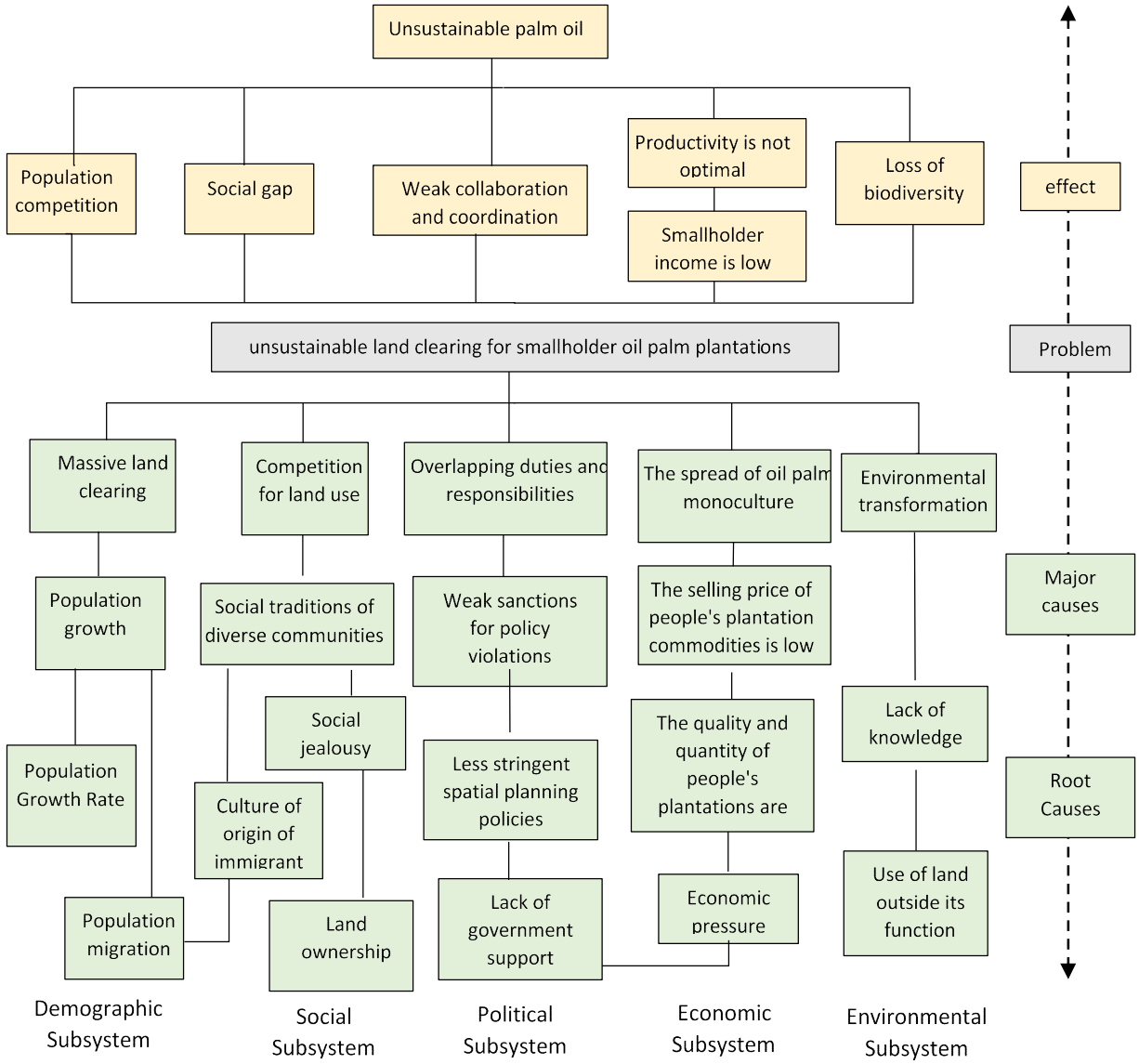

Fig. 6: Problem Tree Analysis.

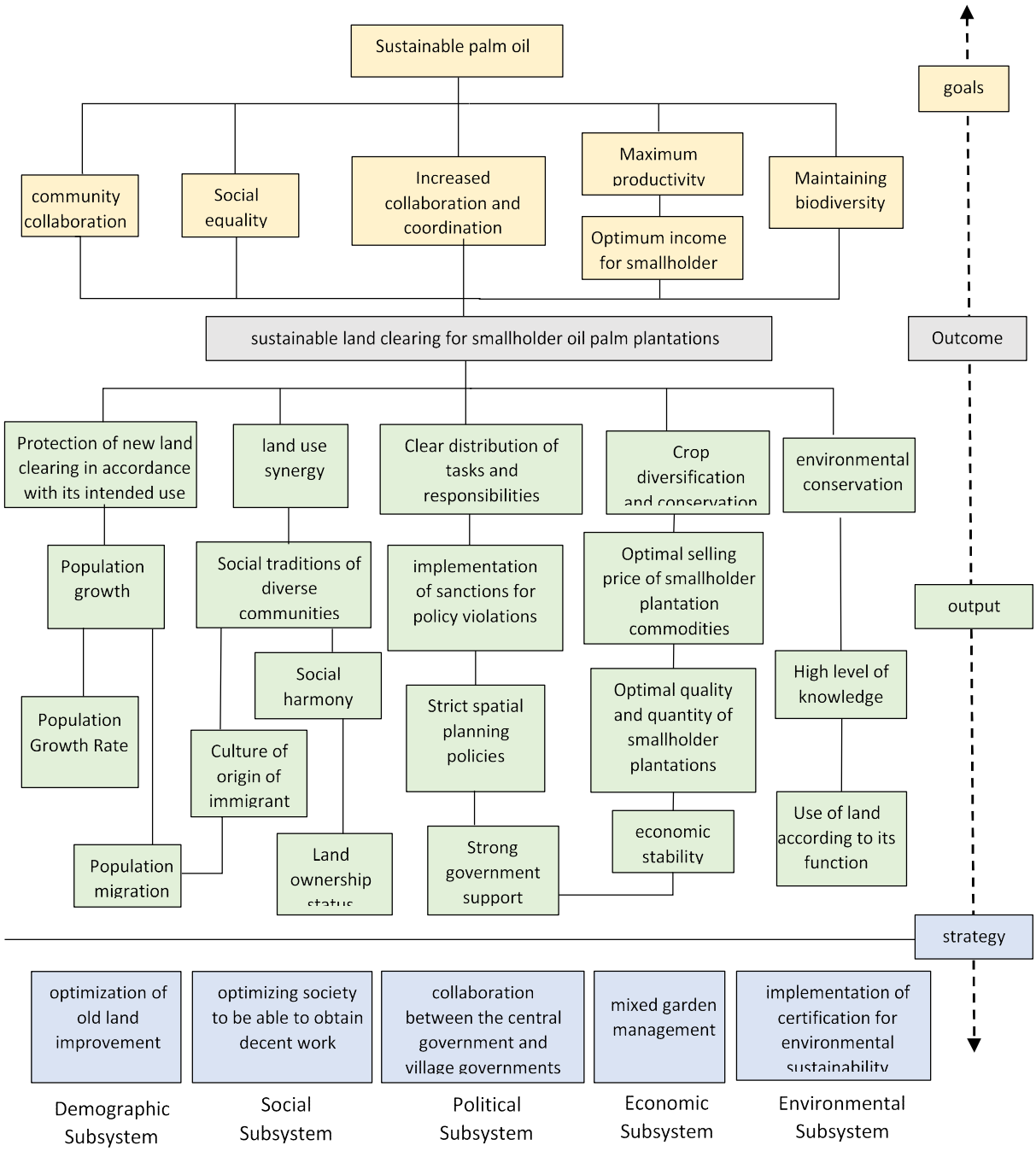

Fig. 7: Strategy Tree Analysis.

is in accordance with previous research (Meijaard et al., 2018; Agus & Pravitasari, 2025). The massive land clearing (demographic subsystem), initiated by continued population growth, coupled with the influx of migrants, will contribute to population growth in a region. This demographic pressure indirectly leads to an increase in demand for palm oil, which also drives land clearing (Alfarisi et al., 2024; Reshi et al., 2025). The proposed strategy to address demographic drivers is to optimize the improvement of existing land. This is consistent with research by Siregar et al. (2024) and Mayarni et al. (2025) which states that replanting is a viable solution to improve the sustainability of smallholder oil palm farmers. However, in reality, smallholder oil palm farmers often struggle or are unprepared to implement good agricultural practices during replanting, resulting in lower yields (Hutabarat et al., 2019; Siregar et al., 2018 Jelsma et al., 2024; Anggraini et al., 2025; Brizuela-Torres et al., 2025). Therefore, the key activity that supports this is the important role of the government in being able to carry out identification activities and provide subsidy funds to smallholder palm oil plantations (Luttrell et al., 2018; Nurfatriani et al., 2019).

Competition for land use (social subsystem) between immigrants and local communities is driven by significant

gap that results in social jealousy (Prasetya et al., 2025), making them more diverse and complex, can trigger competition and conflict (McGuirk & Burke, 2020; Bandiera, 2021; Abram et al., 2022). This is consistent with research by Lawrence et al. (1998) & Maswadi et al., (2018) there are socioeconomic factors facing palm oil smallholders that can dramatically influence behavior to increase the rate of forest conversion. One such factor is that oil palm in this region has been shown to contribute significantly to farmer incomes and improve economic prospects for rural development (Wisena et al., 2014; Siradjuddin, 2015; Kospa, 2016; Potter, 2016; Bissonnette and De Koninck, 2017; Nesti et al., 2018; Afrinandos et al., 2019; Pitriani et al., 2019; Purba, 2019; Heriyanto et al., 2021; Ayompe et al., 2023). The strategy of optimizing the ability of small farmers to obtain decent work aims to ensure that small farmers can meet their living needs, thereby reducing dependence on land clearing for oil palm plantations. In this context, strengthening "participatory communities" in rural areas for smallholder oil palm farmers is a crucial approach. Smallholder oil palm farmers are trained to not only rely on oil palm cultivation but also manage various other productive businesses. This is also in line with research Paul et al. (2021) which states that smallholder palm oil holders usually cultivate a variety of crops and raise livestock.

Furthermore, the economic pressures faced by smallholder oil palm farmers, whether due to limited access to capital, fluctuating market prices, or high maintenance costs, can directly impact the low quality and quantity of yields. As a result, the productivity of smallholder plantations does not reach its optimal potential, while farmers' incomes remain low and unstable (Yeni et al., 2026). This may encourage some farmers to seek ways to expand their land through monoculture palm oil, at the expense of food crops and other local crops (economic subsystems). This is in line with research by Susanti et al. (2020), which states that the widespread implementation of monoculture has caused various environmental and social problems, as well as impacting smallholder farmers' incomes. The diversification in palm oil plantation management strategy aims to protect the smallholder's palm oil economy (Kusumawati et al., 2024) from the risk of falling palm oil prices due to global competition; and to improve smallholder productivity and facilitate greater access to financing (Dermoredjo et al., 2025). This is also emphasized by research from India, which states the importance of agricultural diversification to increase global competitiveness (Sankar and Kowshika, 2023).

On the other hand, overlapping government duties and responsibilities are the root cause (political subsystem) of land clearing for smallholder palm oil. Lack of government support for smallholder palm oil, whether in the form of technical assistance, financing facilities, or increased production capacity, can impact farmers' ability to manage their plantations sustainably. Furthermore, spatial planning policies that have not been strictly implemented have resulted in weak control over land conversion, including in areas that should not be used for new oil palm plantations. This condition is further weakened by violations of the law enforcement system, which often go unsanctioned. This is consistent with research by Djatmika et al. (2023), which states that smallholder farmers in Indonesia are still marginalized by applicable regulations.

Smallholder oil palm cultivation practices that fail to understand the importance of crop diversification and prefer monoculture can result in uncontrolled and unsustainable land clearing for oil palm plantations, resulting in environmental transformation (environmental subsystems). This is consistent with previous research that suggests that permanent monoculture that not only result in deforestation but affecting the balance of biodiversity and ecosystems, but also endanger the living conditions of surrounding communities (Miettinen et al., 2012; Carlson et al., 2018; Jackson et al, 2020; Lee et al., 2020; Meijaard et al., 2020; Marún-Uparela et al., 2025). The strategy for implementing certification for environmental sustainability aims to minimize environmental damage. However, community participation in certification remains low. This is because the income structure of smallholder households is insufficient to support Indonesian Sustainable Palm Oil (ISPO) certification unless fundamental improvements in productivity are made (Dharmawan et al., 2019). In addition, previous research also stated that smallholder perceptions of rejuvenation and Roundtable on Sustainable Palm Oil (RSPO) adoption tend to have a negative correlation with smallholder household welfare (Napitupulu et al., 2021). Therefore, which indicates the need to enforce policies that consider the role of farmers as contributors to household income (Yanita et al., 2021; Mayarni et al., 2024). This study combines predictive approaches, driving factor dynamics, and environmental carrying capacity strategies as anticipatory planning tools to prevent the expansion of unsustainable smallholder oil palm plantations.

Conclusion

The five driving factors for land clearing for smallholder palm oil include demographic, social, economic, political, and environmental factors. Economic factors are the most dominant driving factor. Based on stakeholder interview analysis, there are five strategies resulting from the LFA method: (1) optimizing old land improvement by local communities; (2) optimizing communities to obtain decent jobs; (3) diversification of palm oil plantation management to reduce the risk of falling palm oil prices, while simultaneously improving the community's economy; (4) collaboration between the central government and village governments in regulating policies related to integrated smallholder oil palm plantations; (5) implementing certification for environmental sustainability. It can be concluded that the implementation of these five strategies has great potential to significantly reduce the driving factors that can have an impact on the expansion of smallholder oil palm land clearing, thereby supporting more sustainable land use management and improving environmental quality.

DECLARATIONS

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Data Availability: All data generated or analysed during this study are available from the corresponding author upon reasonable request.

Ethics Statement: Approval was granted by the School of Environmental Science Universitas Indonesia (Aproval No. KET-065/UN2.F13.D1.KE1/PPM.00/2024).

Author's Contribution: Laras Andria Wardani: performed the sampling, data analysis, interpreted the data and results, and prepared the manuscript text. Tri Edhi Budhi Soesilo; Herdis Herdiansyah, and Evi Frimawaty has contributed in supervising the first author in the data, interpreted the results, and preparing the manuscript

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