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Inclusive Islamic Financing for Advancing Sustainable Intensification among Oil Palm Smallholders

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Abstract: This study develops an Islamic financing model designed for the independent oil palm smallholders in West Pasaman, Indonesia that supports sustainable intensification. Using the Research and Development (R&D) approach of design science, combining survey and interview data from 187 farmers and 15 expert informants respectively. The findings demonstrate that the economically viable sustainable intensification of oil palm smallholders in West Pasaman is challenged by a lack of adequate planting material, poor financing, and limited technical capabilities coupled with fragmented institutional coordination. However, there is considerable potential in the region for oil palm-cattle integration and for intercropping. The study proposes a financing model that integrates Islamic commercial and social finance with technical support and institutional collaboration. This study contributes to existing financing literature by asserting that Islamic finance is a source of capital collaboration mechanism for oil palm smallholders to shift toward more sustainable in farming intensification systems.

Keywords: Inclusive Islamic Finance, Sustainable Intensification, Oil Palm Smallholders, Islamic Social Finance, Agricultural Transformation

Introduction

Sustainable development in the oil palm sector has focused on the intensification of smallholders' oil palm cultivation practices, as it allows greater productivity, improved livelihoods, and better environmental outcomes, which are all significant for smallholders (Lyu et al., 2022; Knoke, et.al 2022; Sibhatu, 2023). Independent oil palm smallholders are expected to grow their operational land while fostering ecological self-restraint and supporting household resilience (Dalheimer et al., 2022; Sukiyono et al., 2022). In practice, however, such operational land self-restraint is still very difficult to achieve. This is because many smallholders are experiencing low

productivity due to several reasons such as inadequate provision of technical support, weak extension services, and limited access to affordable finance. This is why, for many smallholders, sustainable intensification is no longer a mere agronomic practice but a financial and institutional challenge.

The existing studies on this topic are numerous, but critical areas are still left unaddressed. The majority of research on sustainable intensification has concentrated on agronomic improvements, increases in productivity, and the reduction of environmental risks (Chiriaco et al., 2022; Palosuo et al, 2021). In contrast, a different set of studies has dealt with the issues of funding gaps, rural credit, and smallholders' economic fragility (Dharmawan et al., 2021; Siti-dina et al., 2023). In a similar manner, another body of work focuses on the social and commercial aspects of the Islamic finance system, especially in relation to the economic empowerment of and the promotion of productive economic activity (Khurshid et al., 2024; Saleem et al., 2024). Nevertheless, these literatures have rarely been brought together to explain how Islamic finance could be conceptualized as a practical and inclusive tool to foster sustainable intensification outcomes among oil palm smallholders. Empirical evidence from Indonesia, particularly in West Pasaman, remain limited in showing how Islamic social and commercial finance can be linked with technical assistance, farmer institutional strengthening, and market access to address productivity and sustainability challenges. This leaves an important analytical gap at the intersection of production needs, financing mechanism, and institutional arrangements for sustainable smallholder intensification.

This gap is especially relevant for West Pasaman, West Sumatra, Indonesia. The region is an important oil Palm producing area where independent smallholders play a central role in the local rural economy. At the same time, many smallholders continue to experience structural constraints, including aging and poor quality planting materials, uneven use of improved cultivation practices, irregular fertilization, weak access to extension services, and inadequate financial capacity. Despite these constraints, West Pasaman has considerable potential for more sustainable production systems. Intercropping can be developed in immature oil palm plantations, while oil palm and cattle integration offers opportunities for biomass recycling, income diversification, and reduced dependence on chemical inputs. These conditions make West pasaman a relevant empirical setting for developing an inclusive Islamic financing model that is not limited to credit provision, but also supports technical, institutional, and ecological transformation.

Against this background, the present study develops an inclusive Islamic financing model to promote sustainable intensification among independent oil palm smallholders in West Pasaman. It addresses three research questions. First, what is the current state of sustainable intensification among smallholders in the study area. Second, what opportunities and constraints influence the adoption of sustainable intensification practices. Third, what Sharia-compliant financing arrangements can facilitate the transition toward more sustainable intensification systems. This paper contributes to the literature in two main ways. First, it provides context specific empirical evidence from West Pasaman on how agronomic, institutional, and financial constraints shape the sustainable intensification process among independent oil palm smallholders. Second, it develop an integrated Islamic financing architecture model that links redistributive Islamic social finance, productive Islamic commercial finance, technical assistance, and cross-sector collaboration within a single framework for smallholder transformation. By doing so, the study

advances the argument that Islamic finance should not be understood merely as a source of capital. It should be viewed as an institutional mechanism that can connect sustainability goals, smallholder productivity improvement, and inclusive rural development.

Literature Review

Inclusive Islamic Finance

Islamic social finance is commonly understood as a financing framework that combines redistributive justice with productive inclusion. Unlike conventional financial intermediation, it is not limited to market based transactions. It also considers ethical distribution, social responsibility, and the inclusion of groups that are excluded from the formal financial system (Maulina et al., 2023; Tok & Yesuf., 2022). Instruments such as zakat, infaq, sadaqah, waqf, *qard* and *qard hasan* are expected to ease liquidity constraints, support vulnerable households, and strengthen the productive capacity of the poor (Cahyandari et al., 2023; Oumaima., 2020). Such financing is especially is especially relevant in agriculture, where poor farmers often require immediate livelihood support before they can invest in improved inputs, farm rehabilitation, or diversification (Ahmed & Aassouli., 2022; Caple & Roddy., 2023). Some studies view Islamic social finance mainly as a welfare based redistribution mechanism. Others argue that it can serve as catalytic capital for productive transformation when linked to capacity building, institutional support, and income generating activities (Kamal, I., 2025; Mohd Hussin, et.al 2024).

Islamic social finance can serve as a preparatory mechanism for moving vulnerable farmers toward more productive and sustainable farming systems. This role can be complemented by Islamic commercial finance in the transformation of agriculture. Different contract types, such as *mudharabah*, *musyarakah*, *murabahah*, and *salam* provide alternatives to support input financing, farm equipment, pre-harvest liquidity, and investment in diversification (Harahap & Risfandy, 2023; Maulina et al., 2023; Saleem et al., 2024). However, Islamic commercial finance also face a practical tension. Although it is normatively associated with risk sharing and ethical partnership, it is often implemented through fixed repayment or sale-based arrangements that may not fully reflect the uncertainty of smallholder agriculture (A. Aziz & Pandey, 2020; Kato, 2022). This tension highlights the need for an integrated financing architecture that combines social protection, productive financing, technical assistance, and institutional coordination (Asmawi, 2023; Benitez-Altuna & Materia, 2023). Even so, existing studies have not adequately shown how these instruments can be combined in practice to support sustainable intensification among independent oil palm smallholders. This unresolved issue provides the basis for the present study.

Sustainable Intensification

Sustainable intensification involves increasing agricultural output on existing land while reducing environmental pressure and improving long term resource efficiency (Ajibade et al., 2023; Lyu et al., 2022). In the oil palm sector, this concept is particularly relevant for smallholders, who are generally farmer managing relatively small oil palm plots with their own land (Marinus et al., 2023). For these farmers, sustainable intensification means improving fresh fruit bunch productivity and household income from existing plantations without expanding cultivated land. Previous studies have linked this process with improved planting materials, better nutrient

management, certification, diversification, agroforestry, and more efficient use of farm resources (Issahaku & Abdulai, 2020; Iddris et al., 2023). However, sustainable intensification should not be treated merely as a technical package, since its outcomes depend on farm level capacity, financial access, institutional support, and market incentives (Palosuo et al. 2021).

Sustainable intensification for oil palm smallholders is both a strategy to improve productivity and a pathway toward more sustainable farming practices. Farmers may recognize the benefits of improved seeds, intercropping, organic fertilizer, or biological pest control, but still fail to adopt these practices because of cost, risk, limited knowledge, weak extension services, or uncertain returns (Micha et al., 2020). This is especially important for independent smallholders, whose farming decisions are often shaped by household resources rather than by structured support from companies or state agencies. Sustainable intensification should therefore be understood as a social and technical transformation rather than a purely agronomic intervention (Chiriaco et al., 2022; Majid et al., 2021). Evidence reviewed by Budiman et al. (2025) shows that such efforts can improve smallholder productivity and income, although their outcomes vary widely across contexts depending on technology, policy support, institutional capacity, and access to finance.

Table 1. The Impact of Intensification Sustainable on Productivity and Income of Oil Palm Smallholders in 10 Countries

Country	Forms of IS Practice	Increase in Productivity (%)	Increase in Revenue (%)
Indonesia	Agroforestry, water & nutrient management	15%	10-15%
Malaysia	High-yielding varieties and RSPO certification	20%	12-18%
Thailand	Training in precision agriculture technologies	12%	8-12%
Colombia	Utilization of bioenergy derived from palm oil waste	18%	14%
Nigeria	Land diversification an pest-resistant crop varieties	10%	7%
Pantai Gading	Nutrient management technologies and organic fertilization	13%	9%
Guatemala	ISPO and RSPO certification schemes	25%	15-20%
Honduras	Crop rotation and integration with food crops	17%	13%
Ecuador	Application of organic fertilizers and improved varieties	14%	10%
Brazil	Valorization of palm oil waste for bioenergy production	16%	12%

Source: (Budiman et al., 2025)

Table 1 shows that sustainable intensification can improve oil palm smallholders' productivity and income, although the magnitude of improvement varies across countries and practices. Productivity gains range from 10% in Nigeria to 25% in Guatemala, while revenue gains range from 7% to 20%. Higher gains are generally associated with practices that combine technological upgrading and institutional support, such as high yielding varieties, certification schemes, and improved nutrient management. More modest gains appear in contexts where diversification or pest resistant varieties are applied with weaker supporting systems. This pattern suggests that sustainable intensification is not a uniform technical package, but a context specific process shaped by the type of practice adopted, access to inputs, technical assistance, market incentives, and institutional capacity. For independent oil palm smallholders with limited capital and weak

extension support, these practices require appropriate financing and coordination. Thus, Table 1 supports the central argument of this study that sustainable intensification among smallholders requires an inclusive financing model that connects productivity improvement, sustainability practices, technical support, and institutional capacity.

Smallholder Oil Palm Plantations

Smallholder oil palm plantations are typically managed by farmers using their own land, labor, capital, and practical knowledge, with limited involvement from large firms or state agencies in daily operations (Descals et al., 2021; Saha et al., 2022). This gives farmers substantial control over production decisions, while also exposing them to considerable production and market risks when technical and financial support is limited (Dharmawan et al., 2021; Sibhatu, 2023). Particularly in Indonesia, these plantations play a vital role in rural economies by generating income, absorbing labor, and contributing to palm oil supply (Sukiyono et al., 2022). However, their performance is frequently lower than possible, as smallholders continue to deal with persistent financial, technical, managerial, planting, and environmentally sound management constraints (Lai et al., 2022; Williams et al., 2021).

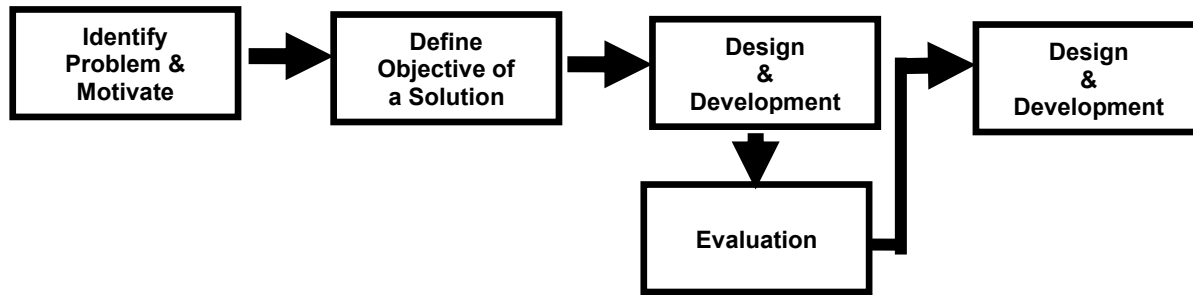
Smallholder oil palm plantations face structural challenges that inhibit their ability to sustain yields, uphold plantation quality, and respond to changing sustainability criteria (Toumbourou & Dressler, 2021; Xin et al., 2021). In smallholder systems, the degree of centralization and integration into formal support services is markedly lower than that in large estates, thus rendering farm performance largely determined by the farmers' own ability to procure labor, capital, and the requisite technical skills (Ruml et al., 2021; Siti-dina et al., 2023; Putri et al., 2022). For these reasons, oil palm systems in smallholder agriculture face particularly important challenges to sustainable intensification. Appropriately applied, sustainable intensification could provide the means to increase productivity and income without additional land and support greater responsibility in farming (Areal et al., 2022; Micha et al., 2020). However, the literature has paid more attention to the potential benefits of these practices than to the conditions that make adoption feasible for independent smallholders facing financial, technical, and institutional constraints (Ariesca et al., 2023; Chiriaco et al., 2022; Maclaren et al., 2022). This unresolved issue is central to the present study.

Methods

Research Design

This study employed a Research and Development (R&D) approach informed by the design science research paradigm proposed by Peffers et al. (2007). This approach was selected because the study aimed to develop a specific financing model for sustainable intensification among independent oil palm smallholders rather than merely test statistical relationships among variables. The research drew on the core stages of design science, including problem identification, objective definition, model design and development, limited demonstration, and evaluation of the proposed product. In this study, the process focused primarily on identifying field-level constraints, formulating design objectives, developing the financing model, and assessing its validity and practicality.

Figure 1. **Stages in Developing an Inclusive Sharia Financing Model for Sustainable Intensification among Independent Oil Palm Smallholders**



Source: Peffers et al., (2007)

Sampling

The study was conducted in West Pasaman Regency, West Sumatra, Indonesia, an area where independent oil palm smallholders play an important role in the local economy. The main unit of analysis was the independent oil palm smallholder, while institutional actors were included as expert informants for model formulation and validation. Population data were obtained from the Pasaman Barat Plantation Office (2021). At the problem identification stage, the study used a multistage stratified sampling approach. First, the study area was classified into three strata based on the level of farmer participation in farmer groups, namely high, medium, and low participation. This stratification was used to ensure that the sample reflected variation in smallholders' institutional engagement. Second, respondents were selected from each stratum to represent different levels of participation in farmer organizations. The sample size for the farmer survey followed the guideline proposed by Roscoe (1975), which remains widely used in social and behavioral research, as noted by Memon et al. (2020) and applied in previous studies such as Lin & Chen (2006), and Sultana (2020). Accordingly, 187 independent smallholder farmers were included in the needs-assessment stage.

At the design and development stage, purposive sampling was employed using an expert sampling technique. A total of 15 expert informants were selected because of their relevance to oil palm plantation management, Islamic social finance, Islamic commercial finance, local governance, economics, Islamic economics, and language. These informants comprised representatives from the Plantation Office, *wali nagari*, Islamic social finance institutions, Islamic financial institutions, and academia. More specifically, the respondent profile included two Plantation Office officers, five wali nagari, one representative of an Islamic social finance institution, one representative of an Islamic financial institution, two academics, and four validators. For the limited demonstration stage, the participants consisted of 23 farmers, one plantation officer or extension worker, one representative of an Islamic social finance or Islamic financial institution, five representatives of farmer groups or associations, and one academic.

Data Collection

The study used both primary and secondary data. Secondary data were obtained from official plantation records and related documents from the West Pasaman Plantation Office. Primary

data were collected through structured questionnaires, in-depth interviews, expert validation sheets, and practicality questionnaires. The survey of 187 farmers was designed to capture the current condition of smallholder plantations, sustainable intensification practices, participating in farmer groups, financing constraints, and the need for an appropriate financing model. In-depth interviews with expert informants were conducted to obtain substantive input on agronomic constraints, diversification opportunities, financing options, institutional support, and local implementation requirements. These findings were then used to develop a model book and an implementation guidebook, both of which were subsequently assessed through expert validation and limited user testing.

Measures

The study applied several measures corresponding to the different stages of R&D. First, the farmer questionnaire at the needs-assessment stage measured the practical condition of smallholder plantations, current farming practices, participation in farmer groups, constraints to sustainable intensification, and financing needs. Second, the expert validation instrument was used to assess the relevance and adequacy of the developed model and guidebook. In line with the original design of the study, the expert sheet evaluated dimensions such as content feasibility, model feasibility, presentation quality, graphical quality, and language clarity. Third, the practicality instrument used in the demonstration stage measured users' responses to the guidebook, including attractiveness, clarity of information, completeness of content, visualization and illustration, and suitability to local conditions. Content validity was assessed through expert judgment and calculated using Gregory's formula (Gede et al., 2021; Sugihartini et al., 2020):

$$Cv = \frac{D}{A + B + C + D}$$

Where Cv is the content validity coefficient; A refers to items judged not relevant by both experts; B and C refer to disagreement cells between the two experts; and D refers to items judged relevant by both experts. In the validation matrix, expert ratings were first grouped into not relevant (scores 1-2) and relevant (scores 3-4). The interpretation of the validity coefficient followed Guilford's classification (Fazlina, 2018; Gede et al., 2021): $0.80 < r_{xy} \leq 1.00$ = very high validity; $0.60 < r_{xy} \leq 0.80$ = high validity; $0.40 < r_{xy} \leq 0.60$ = moderate validity; $0.20 < r_{xy} \leq 0.40$ = low validity; $0.00 < r_{xy} \leq 0.20$ = very low validity; and $r_{xy} \leq 0.00$ = invalid. The practicality of the model was measured from user responses using the following formula (Hasanati et al., 2021; Sinensis et al., 2022):

$$\% \text{ of trial-subject responses} = \frac{\text{total obtained score}}{\text{maximum expected score}} \times 100\%$$

The practicality score was interpreted as follows (Hasanati et al., 2021; Sinensis et al., 2022): 75%-100% = very practical (no revision required); 50%-74% = practical (partial revision required); 25%-49% = less practical; and 0%-24% = not practical.

Data Analysis

Data analysis combined quantitative and qualitative procedures. Quantitative analysis was applied to the expert-validation data and the practicality-test data by using Gregory's coefficient and percentage-based practicality scores, respectively. These procedures were intended to establish the validity and practicality of the proposed model and implementation guide. A qualitative approach with descriptive data analysis is developed based on problem needs. Data were collected through interviews with the informants who understand the field of oil palm plantations and Islamic finances. An interview is a method of collecting information for research purposes by asking and answering questions (Diab et al., 2022; Gerson & Damaske, 2021)

According to Imran & Almusharraf (2024), data processing and analysis are efforts that involve working with data, organizing and sorting it into processable categories, synthesizing it, searching for data and patterns', determining what is important and what is learned, and deciding what can be conveyed as the research results. Meanwhile, Sugiono defines data analysis as the process of systematically searching for and compiling data obtained from interviews, field notes, and documentation by organizing data into categories, describing them into units, synthesizing, arranging them into patterns, deciding what is important and what will be studied, and drawing conclusions that are simple to understand by oneself and others. Thus, data analysis is performed from the beginning to the completion of the study in order to develop conclusions based on the processing outcome. The data will be examined when it has been collected. Data analysis techniques include data reduction, data presentation, and conclusion. Data reduction entails summarizing, selecting the essential point, focusing on the most important points, and searching for the theme and patterns. Then, data is presented in a variety of formats including brief descriptions (narratives), charts, and correlations between categories. Data is sorted and displayed in a relationship pattern through data presentation, making it easy to understand and develop conclusion (Bragstad et al., 2014).

Findings

Current Condition of Sustainable Intensification among Smallholders

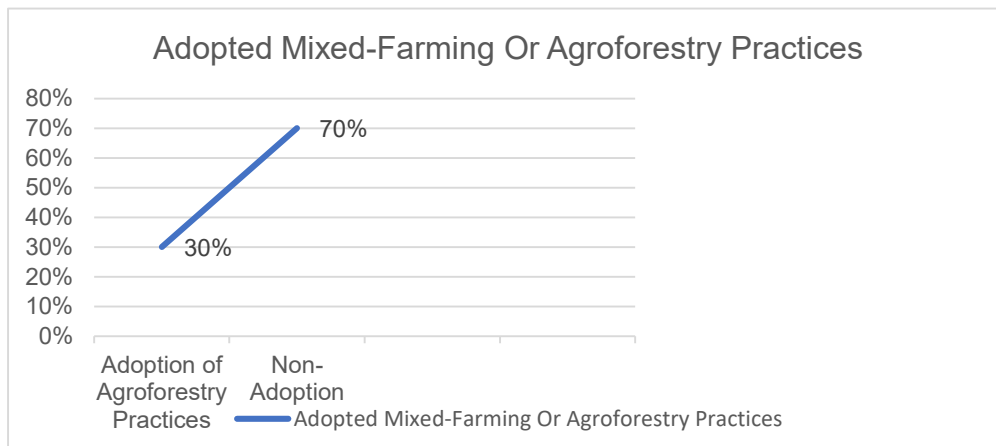
The findings indicate that sustainable intensification among independent oil palm smallholders in West Pasaman remains partial and uneven. Many plantations established between 1998 and 2005 used uncertified planting materials, resulting in shorter productive life, low average yields of around 2 tons per hectare, irregular fertilization, limited use of biological pest control, and weak access to extension services. These conditions show that the main constraints are not only agronomic, but also institutional and financial. As expressed by DM:

“The main problem faced by farmers today is that they are faced with the consequences of using bad seeds previously. This is often found among farmers who planted in 1998-2005. As a result, the productive age of their plantations is relatively short (average 10 years), and the average plantation productivity is 2 tons/ha” (Interview 2025).

The survey results further confirm that diversification has not become a dominant strategy among smallholders. Figure 2 illustrates the only 30% of the 187 surveyed farmers had adopted mixed farming or agroforestry, while 70% continued to rely on monoculture oil palm cultivation.

This pattern suggests that most smallholders remain exposed to production and price risks because their livelihood strategies are still concentrated on a single crop.

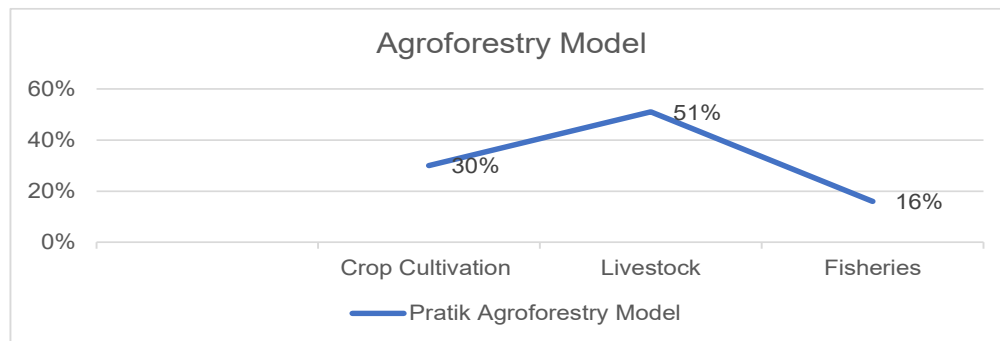
Figure 2. **Adoption of Mixed Farming or Agroforestry among Independent Oil Palm Smallholders**



Source: Primary Data Processing (2025)

Among farmers who had diversified, Figure 3 shows that livestock integration was the most common option at 51%, followed by crop farming at 33% and fisheries at 16%. This indicates that farmers tend to choose diversification practices that fit more easily with existing land use, labor arrangements, and income expectations.

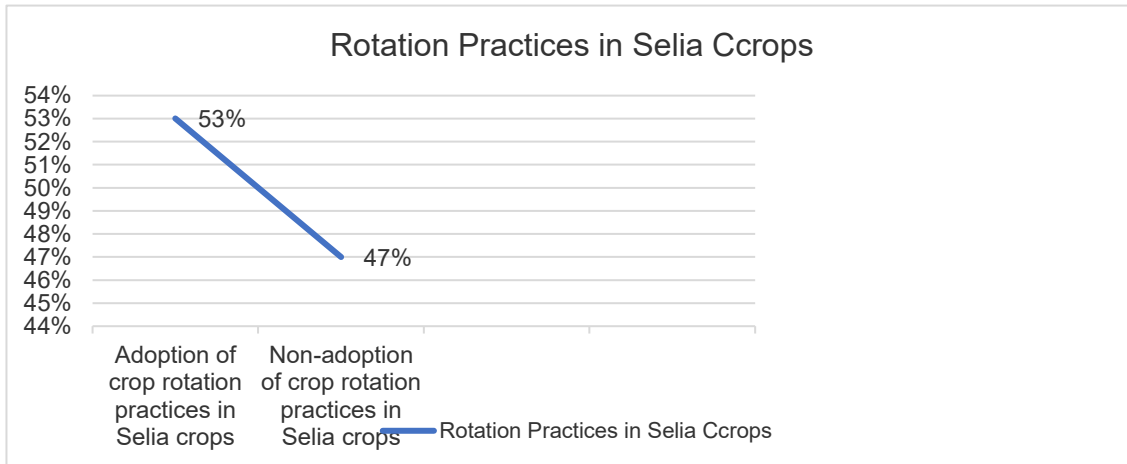
Figure 3. **Forms of Agroforestry Diversification among Independent Oil Palm Smallholders**



Source: Primary Data Processing (2025)

The adoption pattern also shows that sustainable intensification becomes weaker when practices require more complex planning and ecological management. Figure 4 indicates that, among farmers practicing intercropping based diversification, 53% had adopted crop rotation, while 47% had not. This near balanced distribution suggests that initial diversification is more acceptable than systematic rotational management.

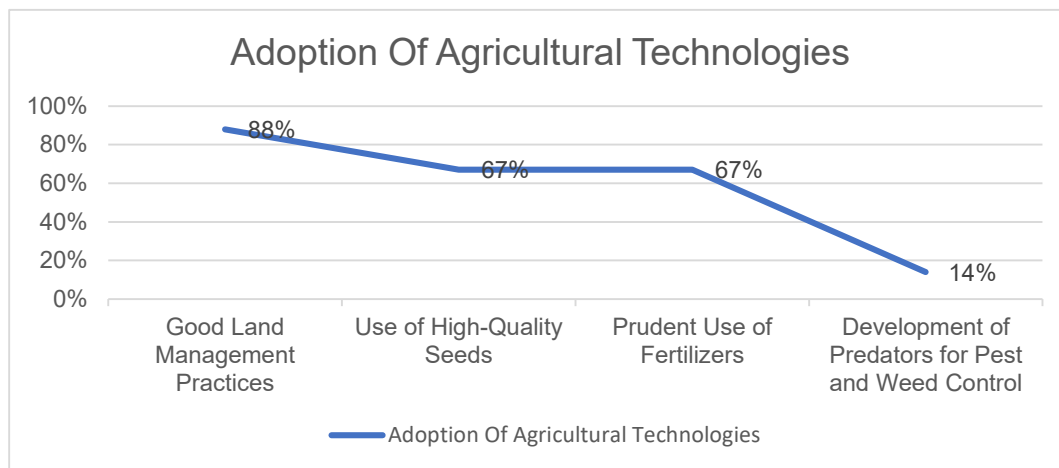
Figure 4. Adoption of Crop Rotation within Intercropping-Based Diversification



Source: Primary Data Processing (2025)

A similar pattern appears in Figure 5. Good land management was reported by 88% of respondents, while the use of superior seeds and prudent fertilizer use each reached 67%. In contrast, the development of natural predators for pest and weed control was reported by only 14% of respondents. Farmers are therefore more likely to adopt practices that are simple, familiar, and closely related to productivity improvement, while practices requiring ecological knowledge, longer time horizons, and greater institutional support remain limited.

Figure 5. Adoption of Selected Agricultural Technologies among Independent Oil Palm Smallholders



Source: Primary Data Processing (2025)

These findings reveal that sustainable intensification among independent oil palm smallholders should not be understood as a uniform technical package that can be adopted once farmers receive information. Instead, it operates as a gradual adoption process shaped by complexity, risk, finance, knowledge, and institutional support. The evidence from West Pasaman indicates a clear adoption gradient, in which productivity oriented practices are more widely adopted, while deeper ecological and system based practices remain weak. This supports the central argument of

the study that sustainable intensification requires an integrated support architecture that connects financing, technical assistance, farmer institutions, and locally relevant diversification pathways.

Challenges and Potential for Sustainable Intensification Practices in Oil Palm Smallholders

A second major finding concerns the coexistence of significant barriers and substantial opportunities. Interview results consistently show that farmers are slow to adopt new cultivation practices unless they can observe visible proof of success from other farmers. This conservative adoption pattern slows the diffusion of innovation and weakens the effectiveness of external interventions. At the same time, limited knowledge of plantation management, inadequate counselling, high fertilizer prices, and restricted financing access continue to constrain farmers' capacity to improve productivity.

This finding is important because it shows that the bottleneck is not simply technological availability. The deeper problem lies in the absence of a credible adoption pathway that connects knowledge, demonstration, financing, and technical assistance. Sustainable intensification is therefore not constrained by a lack of agronomic options alone, but by the fragmented way in which those options reach farmers. Where extension is weak and financing is inaccessible, even technically feasible practices remain difficult to adopt.

According to DM, the primary problem faced by smallholders is that they are sluggish to adopt new gardening techniques; they will do so if there is verifiable proof that the techniques have been applied successfully. As a result, it is difficult to implement effective interventions. Meanwhile, the supporting factors for sustainable intensification practices implemented at the oil palm smallholders' level are that land and climate technically strongly support sustainable intensification in West Pasaman. According to SF, the main challenge faced in implementing sustainable intensification practices is the lack of farmer knowledge in adopting sustainable intensification practices in the plantation sector.

“For oil palm cultivation at the farmers' level, it is still constrained by their lack of knowledge about those practices” (Interview 2025).

A similar thing was also expressed by IBL, that:

“Farmers have limited expertise about plantation management. The government or associated organizations are responsible for providing farmers with technical guidance (Interview 2025).

Other information, ES revealed that the primary challenges for farmers in sustainable intensification practices were financing issues and lack of farmer knowledge, as he expressed:

“Most farmers simply fertilize haphazardly, once or twice a year, especially since the prices are skyrocketing, so farmers are much burdened; some farmers even do not fertilize at all. And, in our perspective, the majority of farmers here still do not understand these practices; basically, planting is enough without maintenance or even fertilizer. What is needed is socialization and counseling from related agencies about

oil palm, starting from selecting seeds, maintaining, and caring, and including how to handle pests” (Interview 2025).”

Despite these constraints, West Pasaman has strong potential for more integrated sustainable intensification. The interviews indicate two feasible diversification pathways. For immature oil palm plantations, particularly those aged zero to four years, farmers can combine oil palm with horticultural or food crops to make better use of available land. For productive plantations, diversification can be developed through the SIKEPI model, which integrates oil palm and cattle while keeping cattle separate from plantation plot to reduce the risk of pest transmission, particularly *Ganoderma*. As DM explained:

“For oil palm aged zero to four years, diversification can be developed through horticultural or food crops. For productive plantations, SIKEPI is recommended by separating cattle from oil palm, using palm fronds as fermented feed and cattle waste as organic fertilizer ” (Interview 2025).

This statement shows that sustainable intensification in West Pasaman can be developed through a circular farming logic. Oil palm biomass can support livestock feed, while cattle waste can be processed into organic fertilizer for oil palm cultivation. This approach may improve resource efficiency, reduce dependence on chemical fertilizer, support land restoration, and cattle additional income sources for smallholders. However, its implementation requires technical guidance, farmer coordination, and appropriate financing support. Thus, sustainable intensification should be understood as a system integration process rather than a simple increase in farm inputs.

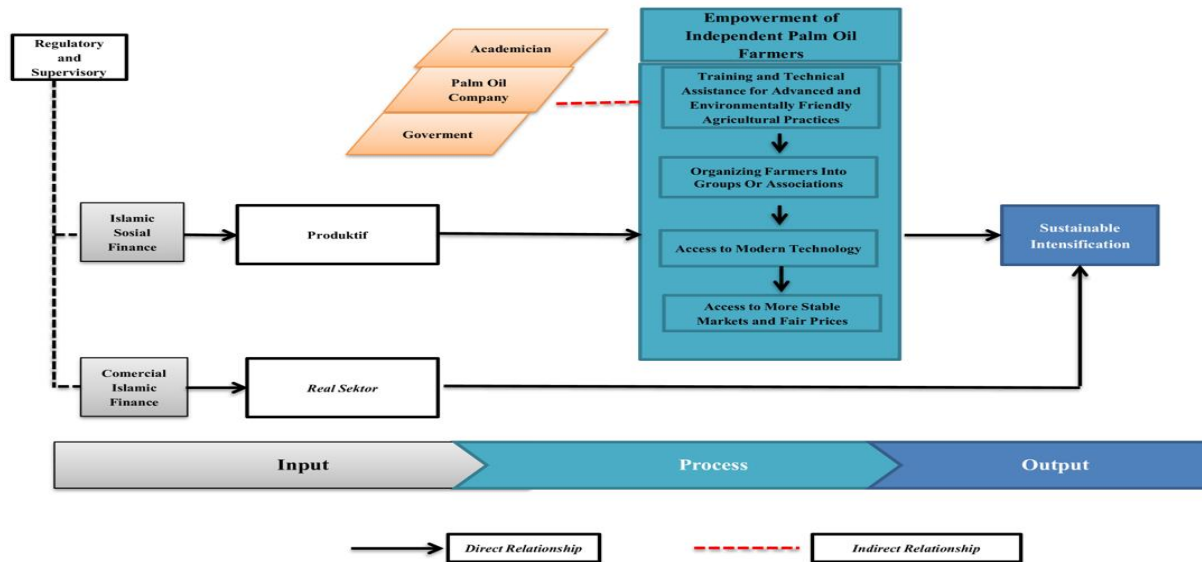
Development of the Inclusive Islamic Financing Model

A third significant finding is the high strategic relevance of the inclusive Islamic finance system for the sustainable intensification process. Both the needs analysis and the expert consultations indicate that Islamic social finance and Islamic commercial finance can play complementary roles in the financing of smallholder transformations. Zakat, infaq, and sadaqoh can be used as catalytic capital for the most vulnerable farmers, especially during the first stages of the farm improvement process. This is also true for Islamic Commercial Financing, which can provide working capital, the purchase of farming tools, and the establishment of productive units pertaining to sustainable intensification.

This finding bears important analytical value in that it diverts the financing discussion from a mono-credit perspective. Smallholders have layered financing needs that go beyond uniform financing needs. Such needs range from subsistence support and rehabilitation financing to financing that removes productivity constraints. It follows that the proposed inclusive Islamic financing model, while being Sharia-compliant, should be recognized as a model that establishes a differentiated financing framework closer to the diverse realities of smallholder farming. It is also worth noting that the model reframes finance as the mere provision of capital. In this study, finance is conceptualized as a vehicle that integrates economic, technical, social, and institutional support, and protective assistance. This conceptualization is important because it is only in this context that finance can be integrated into the sustainable intensification of agriculture beyond the provision of capital. Sustainable intensification of agriculture also depends on financing

integrated into a comprehensive ecosystem of farmer empowerment, knowledge dissemination, and localized action.

Figure 6. **Development of the Inclusive Islamic Financing Model for Sustainable Intensification among Independent Oil Palm Smallholders**



Validity and Practicality of the Proposed Model

The development stage results show that the model is solid in both theory and practice. The model book recorded an overall Gregory coefficient of 1.00 and all the evaluated dimensions were uniformly distributed in the top tier. A 0.92 average validity score of the implementation guidebook was accompanied by a very positive expert approval. However, a score of 0.78 was assigned to the material feasibility component. This indicates that although the guidebook is still solid, some of the texts need to be more developed and detailed.

Table 2. **Validation Results**

Number	Aspect	Component Variable	Gregory Coefficient	Result
1.	Model Book	Model Rationale	1	Excellent
		Content Validity of the Model	1	Excellent
		Graphical Quality of the Model	1	Excellent
		Presentation		
		Design and Language Quality	1	Excellent
2.	Average Guidebook		1	Excellent
		Content Suitability	0,78	High validity
		Construction Suitability	1	Excellent
		Presentation Suitability	1	Excellent
	Average		0,92	Excellent

The validity score distribution is meaningful. The overall high validation results show that the stakeholders believe in the relevance, rationale and validity of the model. The low material feasibility stems from the expectation to address unclear procedural and content issues on the implementation. In development research, this is a positive indicator. It shows that the model is beyond conceptual acceptance and is being assessed from the practical standpoint.

The practicality score further supports this finding. With an average practicality score of 79.24, the guidebook is categorized as highly practical. The maximum score was for book appeal, 82.67, followed by clarity of information, 80.22, relevance to local conditions, 79.33, visuals and illustrations, 78.00, and comprehensiveness of content, 76.00. These scores suggest that potential users perceive the guidebook as easy to understand, practical, with a good fit to the local context.

Table 3. Frequency Data from Model Testing Results

Number	Aspect	Component Variable	Average	Result
1.	Book Appeal		82,67	Very Practical
2.	Clarity of Information		80,22	Very Practical
3.	Comprehensiveness of Content		76	Very Practical
4.	Visuals and Illustrations		78	Very Practical
5.	Relevance to Local Conditions		79,33	Very Practical
	Average		79,24	Very Practical

The score distribution also provides an interesting insight. Users were most positive about presentation and communicative clarity, while for content comprehensiveness the score was the lowest among the assessed indicators. This shows that the guidebook is already a user-friendly tool, but it also indicates that it could be improved as a more detailed and comprehensive technical guide. In practical terms, the product is ready to be used, while its implementation value could be improved by more detailed procedural and operational guidance.

The absence of sustainable pathways in West Pasaman is, in fact, not the issue here. The issue is in the fragmentation of agronomic knowledge, the agronomist's ability to engage, the institution's ability to support, and the farmer's ability to finance. Though Farmers have exhibited some level of movement towards optimal land management and better use of inputs, the movement is yet to manifest into a sustainable transition. The adoption of agroforestry, crop rotation, and biological control is weak, and suggests that, as advocated in the literature, more profound and transformative changes are dependent on improved and persistent support and coordination.

Some of the more recent pioneering Trends shows that the inclusive Islamic finance can act as an enabling architecture in addition to being a source of funds. Therefore, this study's contribution is twofold. For one, it offers an explanation, being locally based, as to why palm oil smallholders are unable to sustainably and fully augment their farming families' incomes. For another, it offers a developmental model that unbundles financing, technological support, economic diversification, and institutional collaboration. This view implies that for Western Pasaman's oil palm smallholders' sustainability, it is more towards the unbundling of financing support, knowledge, and implementation in the field that fully integrated ecosystem support is to be created.

The current study illustrates that the sustainable intensification process among independent oil palm smallholders in West Pasaman remains partial, uneven and not yet systemic. Farmers have adopted some productivity oriented practices, such as improved land management and more efficient pesticide use, but deeper ecological practices, including agroforestry, crop rotation, and biological pest control, remain limited. This pattern supports the view that sustainable intensification should not be treated as a uniform technical package, since its outcomes depend on local agronomic, institutional, financial, and socio economic conditions (Budiman et al., 2025; Palosuo et al., 2021). The study contributes to sustainable intensification theory by showing that adoption among smallholders follows a differentiated trajectory rather than a uniform pathway. Practices that align with existing routines and offer visible short term benefits are more readily adopted, whereas practices that require ecological knowledge, collective coordination, and longer investment horizons tend to advance more slowly.

The findings also show that barriers to sustainable intensification are structural rather than merely behavioural. Poor planting materials from earlier establishment periods, inconsistent fertilization, limited technical knowledge, weak extension services, and cautious responses to unfamiliar practices constrain farmers' ability to transform their plantations. This is consistent with studies showing that weak technical support, limited demonstration, and lack of awareness restrict sustainable development in the palm oil sector (Ariesca et al., 2023; Majid et al., 2021; Marinus et al., 2023). This study extends the literature by identifying limited adoption as a consequence of weak support environments, rather than a simple shortage of agronomic innovation. The theory of sustainable intensification should therefore move closer to the practical realities that shape whether smallholders can adopt, adjust, and maintain improved farming practices.

The economic dimension further strengthens this argument. Sustainable intensification requires continuous investment in inputs, maintenance, farm rehabilitation, and diversification. For smallholders facing liquidity constraints and rising fertilizer costs, these requirements often delay or prevent adoption. Previous studies have shown that limited access to affordable finance, high production costs, and weak institutional support can restrict agricultural transformation among smallholders (Dharmawan et al., 2021; Darwis et al., 2023; Lupenko, & Andros., 2020). This study advances sustainable intensification theory by treating finance as a core transition mechanism that enables smallholders to convert technical possibilities into sustained farming practice. Financing determines whether farmers can move from knowing what should be done to actually implementing improved practices over time. Weak or poorly timed financing turns sustainable intensification into an aspiration rather than a functioning farm level strategy.

Alongside these constraints, the study identifies local pathways for developing a more coherent form of sustainable intensification in West Pasaman. With adequate technical and institutional support, the region's agro ecological conditions can support diversification through intercropping in immature oil palm plantations and oil palm and cattle integration in mature plantations. Intercropping with horticultural or food crops can improve land use efficiency, generate additional income, and support household food security during the non-productive phase of oil palm (Dalheimer et al., 2022; Rodríguez et al., 2024). Meanwhile, the SIKEPI model illustrates how oil palm and cattle integration can create synergies through biomass recycling, feed substitution, and the use of fermented animal waste as organic fertilizer. These findings position sustainable intensification as a locally embedded system redesign process, in which smallholders

reorganize land, biomass, labor, and institutional support into more circular and resilient farming systems. This interpretation is consistent with broader arguments that sustainable farming transitions require circularity, diversification, and stronger environmental accountability (Aziz et al., 2021; Zhao et al., 2022).

Inclusive Islamic finance becomes theoretically important in this transition because smallholders face layered financing needs. Some households require immediate livelihood support, while others need working capital, farm equipment, rehabilitation support, or investment for diversification. A single financing instrument is unlikely to address these different needs, as smallholder finance often requires flexible mechanisms that respond to vulnerability, seasonality, and production risk (Hussein Kakembo et al., 2021). Islamic social finance, such as zakat, infaq, sadaqah, and qard hasan, can support vulnerable farmers in the early stage of transition by reducing liquidity pressure and strengthening basic productive capacity (Khurshid et al., 2024; Widiastuti et al., 2022). Islamic commercial finance, through instruments such as murabahah, salam, mudharabah, and musyarakah, can then support input financing, farm rehabilitation, pre harvest liquidity, and diversification investment (Maulina et al., 2023). This shows that Islamic finance contributes not only through Sharia compliance, but also through its capacity to connect social protection and productive transformation.

Sustainable intensification among smallholders is best understood as a multi-dimensional transition shaped by social capacity, technical practice, financial access, and institutional support. For independent oil palm smallholders, this transition requires more than improved farming techniques. It depends on a support architecture that links financing, technical assistance, farmer organization, market access, and locally relevant diversification pathways. This perspective is consistent with the broader view that smallholder transformation depends on the interaction between knowledge, finance, institutions, and risk sharing mechanisms (Ajibade et al., 2023; Chiriaco et al., 2022). In this sense, the proposed inclusive Islamic financing model advances the theoretical understanding of sustainable intensification by showing how finance can operate as an institutional mechanism for aligning farmer welfare, productivity improvement, ecological practices, and rural transformation.

Conclusion

Sustainable intensification among independent oil palm smallholders in West Pasaman remains partial and uneven. Farmers have made progress in land management and pesticide use, but the adoption of agroforestry, crop rotation, and biological pest control remains limited. This pattern reflects a fragmented farming system shaped by poor planting materials, limited technical capacity, weak extension services, and restricted access to finance. At the same time, West Pasaman offers opportunities for more integrated farming through intercropping in immature oil palm plantations and oil palm and cattle integration in productive plantations. These pathways can improve land use efficiency, diversify income, recycle biomass, and reduce dependence on chemical inputs. However, their adoption depends on a coordinated support mechanism that links agronomic improvement, financing access, technical assistance, farmer organization, and institutional collaboration.

This study develops an inclusive Islamic financing model as a coordinated mechanism for supporting sustainable intensification among independent oil palm smallholders. The model

integrates Islamic social and commercial finance within a single framework for smallholder transformation. Islamic social finance can support vulnerable farmers during early recovery and productive inclusion, while Islamic commercial finance can provide working capital, input financing, farm rehabilitation, and diversification investment. By linking these instruments with technical assistance and institutional partnerships, the model frames finance as an enabling mechanism rather than merely a source of capital. Theoretically, the study reframes sustainable intensification as a social, technical, financial, and institutional transition, while extending Islamic finance scholarship to the operational needs of smallholder agriculture. Practically, the findings call for coordinated action among government agencies, Islamic social finance institutions, Islamic financial institutions, extension services, and farmer organizations. Since the evidence is drawn from one regency and the model has not yet been fully implemented, future research should test it in different smallholder contexts using longitudinal or quasi experimental designs and examine the governance capacity of the institutions involved.

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