DANADYAKSA
POST MODERN ECONOMY JOURNAL

Vol. 4 No. 1, (2026), 109 –121 e-ISSN: 3025-8545

ANALYSIS OF THE APPLICATION OF GOOD AGRICULTURAL PRACTICES (GAP) AND THE FACTORS INFLUENCING IT AMONG INDEPENDENT OIL PALM SMALLHOLDERS IN ACEH TAMIANG REGENCY

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Abstract

The implementation of Good Agricultural Practices (GAP) is a crucial component in meeting the sustainability standards for Indonesian Sustainable Palm Oil (ISPO) certification, which is mandatory for all oil palm industry players, including independent smallholders. As one of the regions with the largest oil palm plantations in Aceh, Aceh Tamiang Regency still faces challenges in GAP implementation due to low technical knowledge, weak institutional support, and limited access to information. This study aims to analyze the factors influencing farmers' perceptions of GAP, as well as identify the obstacles and the actual conditions of its implementation at the smallholder level. The research employed a quantitative method with a survey approach, involving 144 farmers from 18 farmer groups selected through Multistage Quota Sampling. Primary data were collected using a Likert-scale questionnaire and interviews, while secondary data were obtained from relevant institutional documents and scientific literature. The results indicate that farmer characteristics ($\beta = 0.358$), institutional support ($\beta = 0.373$), and access to information ($\beta = 0.375$) have a significant influence on farmers' perceptions of GAP. The main obstacles to GAP implementation include limited technical capacity, insufficient mentoring, and uneven access to information.

Keywords: Oil Palm, GAP, Independent Smallholders, Aceh Tamiang

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Vol. 4 No. 1, (2026), 109 –121 e-ISSN: 3025-8545

INTRODUCTION

Oil palm is a strategic commodity in Indonesia's plantation sector, playing a crucial role in supporting national economic growth. This commodity not only makes a significant contribution to the Gross Domestic Product (GDP) but is also a primary source of livelihood for millions of people, particularly in rural areas (Yutika, Cahyadi and Mulyati, 2019). Beyond its economic contribution, oil palm plantations managed by applying principles of sustainable cultivation have the potential to provide ecological benefits, such as through increased carbon sequestration and improved environmental management. However, it must be acknowledged that plantation expansion also causes environmental impacts such as deforestation, land degradation, and forest fires, often triggered by irresponsible land management practices (Hadi et al., 2023).

Within the context of sustainable oil palm cultivation, Good Agricultural Practices (GAP) serve as a vital foundation to ensure plantation management practices that are both productive and environmentally friendly. GAP encompasses various technical aspects, such as soil and water management, appropriate fertilizer and pesticide use, integrated pest and disease control, plant maintenance, and efficient harvesting and post-harvest practices (Alam and Begum, 2015). Proper implementation of GAP is believed to increase productivity, reduce environmental damage risks, and improve production quality, especially for smallholder farmers.

Aceh Tamiang Regency is one of the central oil palm production areas in Aceh Province, with a continuously expanding plantation area that contributes significantly to the local economy. In 2024, oil palm production in Aceh Tamiang Regency reached 307,214 tons from a total planted area of 24,760 hectares (BPS Aceh Tamiang, 2024). Supported by suitable agroclimatic conditions, smallholder oil palm plantations have developed rapidly and become a key driver of the local plantation sector.

Most oil palm farmers in Aceh Tamiang are independent smallholders who manage their plantations independently without adequate technical or institutional support. This condition results in wide variations in the application of cultivation practices, where some farmers have begun adopting GAP principles, while others still manage their plantations using traditional methods (ICRAF, 2020). This gap indicates that not all farmers have sufficient understanding, technical capacity, or resources to consistently implement GAP. This aligns with the findings of Gilles et al. (2022) that the adoption level of sustainable cultivation practices often lags behind the available knowledge or policies.

REVIEW OF LITERATURE

The following table presents a summary of previous studies containing information related to research titles, researcher names, approaches or methods used, main findings obtained, and their relevance or connection to the research currently designed in this study. This summary is compiled to provide a conceptual and empirical foundation that supports the direction and focus of the current research.

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Table 1.
Previous Research Matrix

No.	Research Title	Researcher(s)	Method	Main Results	Relevance to the Study
1.	Acceptance Of Good Agricultural Practices (GAP) Among Independent Oil Palm Smallholders In Malaysia	(Mansor et al., 2021)	Quantitative; Survey and field observation	Only 26% of independent smallholders met the MPOB GAP certification criteria, 58% partially met them, and 16% did not meet them. The two significant factors influencing GAP compliance were farmers' education level and palm tree age. Fertilization and record-keeping practices proved most significant in enhancing GAP compliance.	The study by Mansor et al. (2021) is relevant as it demonstrates the low adoption of GAP by independent oil palm farmers and highlights the importance of education and technical cultivation factors. These findings align with the focus of this study, thereby strengthening the analysis of GAP adoption in Aceh Tamiang.
2.	Insights from GAP Execution for Yield Intensification Among Independent Smallholder Farmers for Oil Palm	(Lim et al., 2024)	Quantitative	GAP implementation increased FFB (fresh fruit bunch) yield by up to 50% within 2–3 years. The most effective practices included fertilization, pruning, *Ganoderma* sanitation, and regular harvesting. Simpler and cheaper GAPs were more easily adopted.	This research supports the importance of GAP in improving smallholder productivity and shows that GAP adoption depends on cost, complexity, and institutional support, aligning with the research focus on factors influencing

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No.	Research Title	Researcher(s)	Method	Main Results	Relevance to the Study
					GAP adoption in Aceh Tamiang.
3.	Certification, Good Agricultural Practice and Smallholder Heterogeneity: Differentiated Pathways for Resolving Compliance Gaps in the Indonesian Oil Palm Sector	(Schoneveld et al., 2019a)	Quantitative	Farmer compliance with ISPO and GAP standards remains low, with only 2.4% meeting all key indicators. Compliance is highly influenced by socioeconomic characteristics, migration status, access to legal land documents, and institutional support.	This study reinforces the importance of a farmer-characteristic-based approach to understanding GAP implementation barriers. Its focus on GAP and ISPO compliance aligns with this research assessing GAP implementation by independent oil palm farmers in Aceh Tamiang.
4.	Tingkat Pengetahuan Petani Kelapa Sawit dalam Penerapan Good Agricultural Practices (GAP): Sebuah Analisis Rating Scale	(Nasution, Ismiasih and Dinarti, 2023)	Quantitative descriptive with purposive sampling	Farmers' knowledge level of GAP is categorized as moderate (average score 1.83). Farmers do not fully understand or apply GAP principles, especially in land clearing, pest and disease control, and marketing. Main contributing factors are old age, low education, and lack of access to information.	This study is highly relevant as it highlights the limited knowledge of independent oil palm farmers in implementing GAP, which is also the focus of your research. Both emphasize the importance of farmer characteristics and access to information in enhancing GAP adoption.

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No.	Research Title	Researcher(s)	Method	Main Results	Relevance to the Study
5.	Peningkatan Keterampilan Praktik Pertanian yang Baik Petani Sawit Swadaya di Kabupaten Sambas	(Lestari, Nurliza and Oktoriana, 2024)	Quantitative descriptive with Multidimensional Scaling (Rap-Palm Oil)	GAP skill improvement focused on three skill dimensions: technical, human, and conceptual. The most crucial aspect was conceptual skill (extension services, comparative studies, field schools). Extension services were ineffective; farmers relied heavily on personal experience or social media.	Provides an important contribution in explaining the role of conceptual skills and extension in GAP adoption. The emphasis on technical and conceptual skills is highly relevant to Tasya's thesis focus on internal and external factors influencing GAP implementation.

Previous studies on Good Agricultural Practices (GAP) within the scope of Indonesian Sustainable Palm Oil (ISPO) certification by independent oil palm farmers are generally still partial, focusing on specific variables such as land legality, extension services, or technical training. The approaches used have not comprehensively integrated various dimensions, such as individual farmer characteristics, institutional support, perceptions of innovation, local cultural values, and access to information. Furthermore, no study has specifically examined GAP implementation in Aceh Tamiang Regency, which possesses unique social, economic, and institutional characteristics. Therefore, this research aims to fill this gap through a more comprehensive and contextual analysis, to support strengthening smallholder capacity and formulating adaptive policy recommendations tailored to local conditions.

In this study, there are six main latent variables analyzed. **First**, Farmer Characteristics (X1), represented by six indicators: age (X11), education level (X12), farming experience (X13), number of dependents (X14), cultivated land area (X15), and family income (X16). **Second**, Perception of Good Agricultural Practices (GAP) (X2), reflected by perception of relative advantage (X21), compatibility (X22), complexity (X23), ease of trial (trialability) (X24), and observability (X25). **Third**, Institutional Support (X3), consisting of group support (X31), government support (X32), cooperative support (X33), and social support (X34).

Fourth, Access to Technological Information (X4), reflected in the indicators of information media used (X41), variety of information types (X42), and the extent to which

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the information is beneficial to farmers (X43). **Finally**, the dependent variable in this study is the Implementation of Good Agricultural Practices (GAP) (Y), measured through grower institutional organization (Y1), grower management (Y2), and application of technical cultivation practices (Y3). All relationships between these variables are formulated in an SEM model visualized in Figure 2.

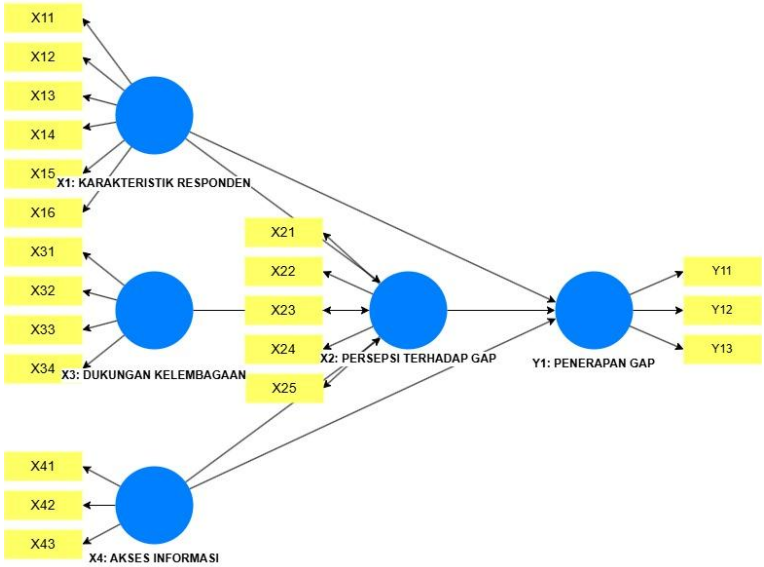

Figure 2. SEM-PLS Path Model

In this study, the steps for the SEM-PLS modeling are as follows:

1. Evaluation of the measurement model (outer model).
2. Testing of the structural model (inner model).
3. Conversion of the path diagram into a system of equations.
4. Estimation and hypothesis testing.

RESEARCH METHOD

This study is quantitative research with a survey approach, conducted in Aceh Tamiang Regency from June to September 2025. The location was chosen purposively as it is the region with the largest oil palm plantations in Aceh. The research subjects are independent oil palm smallholders, focusing on the implementation of Good Agricultural Practices (GAP).

The research population includes all oil palm farmers in Aceh Tamiang. The sampling technique used is Multistage Quota Sampling, a non-probabilistic method carried out in stages: by selecting areas, choosing active farmer groups, determining respondent quotas based on important characteristics, and selecting respondents non-randomly until the quota is fulfilled. The total number of respondents is 144 farmers from 18 farmer groups across six sub-districts. The specific villages were determined during data collection, following the multistage sampling principle when a complete sampling frame was not available.

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Table 2.
Number of Research Samples

Regency	Sub- district	Farmer Groups	Number of Respondents
Aceh Tamiang	Tenggulun	3	8 people
	Tamiang Hulu	3	8 people
	Rantau	3	8 people
	Bandar Pusaka	3	8 people
	Karang Baru	3	8 people
	Kejuruan Muda	3	8 people

RESULTS AND DISCUSSION

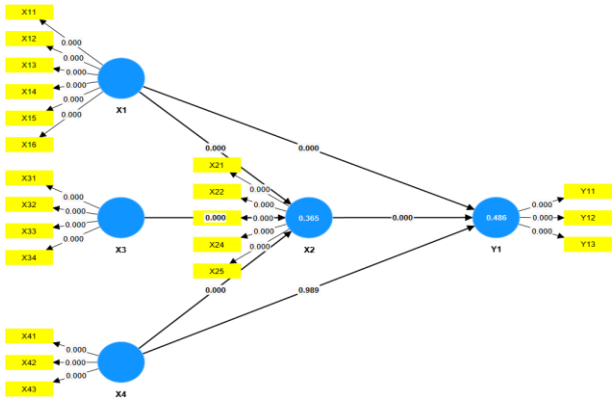

Figure 3.
Inner Model

The results of hypothesis testing conducted through bootstrapping (inner model testing) and the p-values presented in Table 37 indicate that the respondent characteristics variable (X_1) and perceptions of Good Agricultural Practices (GAP) have a p-value < 0.05 with respect to the implementation of Good Agricultural Practices (GAP) by independent smallholder farmers (Y). Therefore, the hypothesis stating that respondent characteristics (X_1) and perceptions of Good Agricultural Practices (GAP) have a direct and significant effect on the implementation of Good Agricultural Practices (GAP) (Y) is accepted.
Meanwhile, institutional support (X_3) does not have a direct effect on the implementation of Good Agricultural Practices (GAP) (Y) due to the presence of mediation effects from other variables. Likewise, information access (X_4) does not have a significant effect on the implementation of Good Agricultural Practices (GAP) (Y), as indicated by a p-value > 0.05; therefore, the hypothesis is rejected.

Direct effects describe the immediate relationship or influence of exogenous latent constructs on endogenous latent constructs. In contrast, indirect effects represent relationships between variables that are mediated by other variables (mediating constructs).

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In other words, the influence of exogenous variables on endogenous variables occurs through intermediary constructs. The value of the indirect effect is obtained by multiplying the path coefficient between the exogenous and mediating variables by the path coefficient between the mediating and endogenous variables, and its significance is then tested using the bootstrapping procedure. The results of the bootstrapping analysis are presented in the following table.

No	Inner Model Evaluation Criteria	Path Coefficient	%	P-value	Effect
1	**Direct Effect**				
	X_1 Respondent Characteristics → X_2 Perception of GAP	0.358	36	0.000	Significant
	X_1 Respondent Characteristics → Y_1 GAP Implementation	0.418	42	0.000	Significant
	X_2 Perception of GAP → Y_1 GAP Implementation	0.447	45	0.000	Significant
	X_3 Institutional Support → X_2 Perception of GAP	0.373	37	0.000	Significant
	X_4 Information Access → X_2 Perception of GAP	0.375	37	0.000	Significant
	X_4 Information Access → Y_1 GAP Implementation	–0.001	–	0.989	Not Significant
2	**Indirect Effect**				
	X_1 Respondent Characteristics → Y_1 GAP Implementation	0.160	16	0.000	Significant
	X_3 Institutional Support → Y_1 GAP Implementation	0.167	17	0.000	Significant
	X_4 Information Access → Y_1 GAP Implementation	0.168	17	0.000	Significant

Based on the established structural model, the structural equation of the factors influencing the implementation of Good Agricultural Practices (GAP) by independent smallholder farmers is expressed as follows:

$Y_1 = 0.418\ X_1 + 0.447\ X_2 + 0.514$ $R^2 = 0.486$

Furthermore, based on the table, it can be explained that the direction of both direct and indirect effects is obtained through the results of path coefficient analysis (path analysis), which is used to test the hypotheses in this research model, as described below.

a. Effect of Respondent Characteristics (X_1) on GAP Perception (X_2)

The characteristics used as measured indicators include age, level of formal education, farming experience, number of family dependents, land size, and household income. The inner model path analysis shows that respondent characteristics (X_1) have a direct and

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significant effect on the perception of Good Agricultural Practices (GAP) (X_2). The path coefficient value of 0.358 indicates that a one percent increase in respondent characteristics increases GAP perception by 35.8%. This effect is statistically significant, with a t-statistic value of 6.015 and a p-value of 0.000.

The positive sign of the path coefficient indicates a positive relationship between age and GAP perception, suggesting that age plays an important role in shaping farmers' perceptions of GAP. Age is a crucial factor in farmers' understanding and perspectives regarding GAP. This finding reflects that independent oil palm farmers are predominantly within the productive age range, defined as 15–55 years, during which individuals still possess the physical capacity and potential to optimally develop their farming activities (Pratiwi & Pinem, 2020). Thus, the age characteristics of respondents in this study represent farmers who are still productive and have strong potential in forming positive perceptions toward Good Agricultural Practices (GAP).

Previous studies indicate that age has an important role in influencing farmers' perceptions of GAP. Farmers with higher levels of formal education tend to have better understanding and perspectives on GAP concepts and techniques, enabling them to apply these practices more consistently. Rahmawati, Muldjono, and Matindas (2023) show that education has a highly significant influence on innovation decision-making, emphasizing that higher educational attainment increases the likelihood of farmers adopting modern agricultural practices such as GAP. This finding is consistent with Rogers (2003), who stated that education enhances farmers' cognitive capacity to receive and implement new agricultural technologies.

b. Effect of Institutional Support (X_3) on GAP Perception (X_2)

Institutional support is one of the variables examined in this study. Institutional support (X_3) consists of four main indicators: farmer group support, government support, cooperative support, and social support. Based on the SEM-PLS analysis, institutional support has a positive effect on GAP perception, with a path coefficient of 0.373. This indicates that a one percent increase in institutional support leads to a 37.3% increase in GAP perception. This effect is statistically significant, as indicated by a t-statistic value of 6.171 and a p-value of 0.000. This significance confirms the existence of a positive relationship between institutional support and GAP perception among independent oil palm farmers.

Furthermore, cooperative support is an important indicator within the institutional support variable in shaping GAP perception. However, not all independent farmers in Aceh Tamiang Regency are registered as cooperative members due to financial constraints. Based on interviews with the head of the Sumber Rezeki I Cooperative in Bandar Pusaka Subdistrict, Mr. Iwan stated:

"Not all oil palm farmers join cooperatives, especially those who are not yet ISPO-certified. The requirements to join cooperatives are very strict. Many farmers face financial constraints because joining a cooperative requires administrative processes and additional costs, such as hiring drones for land mapping. As a result, many non-ISPO farmers are reluctant to join cooperatives because the process is complicated."

These conditions contribute to unfavorable farmer perceptions of GAP. Limited financial capacity, weak collaboration, and insufficient institutional support hinder farmers

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from optimally implementing GAP. Finally, social support also serves as an important indicator of institutional support in shaping farmers' perceptions of GAP. Social support includes the role of local leaders (Datok) in promoting changes related to GAP at the village level, as well as discussions among farmers in collective decision-making processes.

c. Effect of Information Access (X_4) on GAP Perception (X_2)

Information access is one of the variables measuring factors that influence GAP implementation. Although information access does not directly affect GAP implementation (Y), its effect is mediated through GAP perception (X_2). The analysis results show that information access has a significant and positive effect on GAP perception among independent oil palm farmers, with a coefficient value of 0.375. This means that a one percent increase in information access increases GAP perception by 37.5%. This effect is significant and positive, as indicated by a t-statistic value of 5.624.

Information access consists of three indicators: intensity of media use, diversity of information sources, and level of information utilization, all of which significantly influence farmers' perceptions of GAP. In particular, the level of information utilization helps farmers in decision-making, problem-solving, skill development, and expanding knowledge, thereby shaping their perceptions of GAP. The processes of information exchange and social communication among independent farmers are also important factors in practices such as GAP within the context of independent plantation management. Effective communication and appropriate access to information are key elements in improving farmers' perceptions of GAP.

d. Effect of Respondent Characteristics (X_1) on the Implementation of Good Agricultural Practices (GAP) (Y)

The analysis results indicate that respondent characteristics (X_1) have a direct effect on GAP implementation (Y), with a coefficient value of 0.418. This implies that a one percent increase in respondent characteristics is associated with a 41.8% increase in GAP implementation. This effect is positive and statistically significant, as shown by a t-statistic value of 7.740 and a p-value of 0.000, indicating a strong and reliable relationship within the research model.

Respondent characteristics in this study include six main indicators that play a role in encouraging GAP implementation among independent oil palm farmers. Factors such as age, level of formal education, farming experience, number of family dependents, land size, and household income influence farmers' capacity and readiness to adopt good agricultural practices. Therefore, improvements in these characteristics have the potential to enhance GAP implementation more optimally at the smallholder level.

e. Effect of GAP Perception (X_2) on the Implementation of Good Agricultural Practices (GAP) (Y)

The results show that farmers' perceptions of GAP (X_2) have a positive and significant effect on GAP implementation (Y), with a coefficient value of 0.447. This finding indicates that a one percent increase in perception leads to a 44.7% increase in GAP implementation. The significance of this relationship is confirmed by a t-statistic value of 7.330 and a p-value of 0.000, demonstrating that the influence of perception on GAP implementation is statistically strong and not coincidental.

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These findings reinforce the notion that perception plays a critical role in the successful adoption of agricultural innovations. When farmers hold positive perceptions—such as viewing GAP as beneficial, applicable to their land conditions, and not overly complex—they are more likely to adopt and sustain these practices. Conversely, when farmers' perceptions are constrained by limited information, insufficient assistance, or unsuccessful early experiences, GAP implementation may progress slowly or inconsistently. Therefore, interventions such as training programs, field demonstrations, and improved access to information are essential to strengthening positive farmer perceptions and promoting more optimal and sustainable GAP implementation.

f. Effect of Information Access (X_4) on the Implementation of Good Agricultural Practices (GAP) (Y)

The analysis indicates that information access (X_4) does not have a significant effect on GAP implementation (Y). The resulting path coefficient is negative (–0.001), indicating that increased information access does not necessarily lead to higher levels of GAP implementation. This finding is further supported by statistical test results, where the t-statistic value is only 0.013 and the p-value is 0.989. These values exceed the established significance threshold, leading to the conclusion that the relationship between information access and GAP implementation is not statistically significant in the research model.

The non-significant effect of information access suggests that the information received by farmers is not yet fully effective or relevant in encouraging GAP implementation. For instance, field observations show that some farmers are still unfamiliar with internet-based media and social media, and some do not own smartphones, which limits their ability to access and utilize information. In other words, although information may be available, its quality, accessibility, and practical utilization have not been sufficient to directly influence GAP implementation behavior in the field.

CONCLUSION

1. The level of Good Agricultural Practices (GAP) implementation in oil palm cultivation, viewed from institutional, management, and technical aspects, remains low. This condition indicates that farmers do not yet fully understand or optimally apply GAP principles. To improve its implementation, continuous mentoring and training are required, along with collaborative support from all stakeholders, as well as high awareness and willingness from farmers to ensure that GAP implementation can be carried out more effectively and sustainably.
2. The factors influencing the implementation of Good Agricultural Practices (GAP) (Y) are significantly and positively affected by respondent characteristics (X1) and perceptions of GAP (X2). Meanwhile, access to information (X4) does not have a direct effect and shows a negative direction on GAP implementation (Y). However, access to information (X4) has a positive indirect effect on GAP implementation (Y) through the mediating variable of perception towards GAP (X2). Similarly, institutional support (X3) and respondent characteristics (X1) also contribute indirectly through perception in enhancing GAP implementation.

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