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Acceptance and Awareness of Oil Palm Smallholders toward Integrating Farming Systems in Malaysia: A Case Study in Keratong Rompin District in Pahang

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Abstract

This study investigates the acceptance and awareness of smallholders in Malaysia toward integrated farming systems within the oil palm sector. It explores key factors influencing smallholder decisions, including yield enhancement, income optimization, additional productivity, cost minimization, and risk mitigation. Data were collected through questionnaires distributed to 160 smallholders in Keratong Rompin, Pahang. The results indicated that increased yield and income significantly influenced the acceptance of integrated farming, highlighting their importance in decision-making. However, the study also found that low levels of awareness about integrated farming remain a significant barrier to adoption. The findings suggest that government promotion, education, and support are crucial for overcoming these challenges and improving smallholder adoption of integrated systems, thereby enhancing productivity, economic resilience, and sustainability in the sector.

Keywords: Acceptance, Awareness, Smallholders, Integrating Farming and Sustainability

Introduction

Agriculture has historically been one of Malaysia's key economic sectors, contributing significantly to the nation's GDP. Among the various crops, oil palm (Elaeis guineensis) stands out as one of the most vital, making Malaysia the second-largest producer of palm oil in the world. The oil palm industry not only supports the country's economy but also provides livelihoods for many smallholder farmers. However, the agricultural sector, particularly oil palm cultivation, is under pressure due to increasing reliance on food imports, limited land availability, and fluctuating global commodity prices.

In response to these challenges, integrated farming systems have been proposed as a sustainable solution to improve productivity and maximize land use efficiency. Integrated farming involves the combination of oil palm cultivation with other agricultural activities such as livestock rearing and the intercropping of cash crops like bananas, maize, and pineapples. This system offers numerous advantages, including increased yields, enhanced soil fertility, reduced dependency on chemical inputs, and diversified income streams for farmers. However, despite these benefits, the adoption rate of integrated farming systems among Malaysian smallholders remains low.

The Malaysian Palm Oil Board (MPOB) has actively promoted integrated farming systems as a means of improving both food security and the financial well-being of smallholders. By combining oil palm with livestock, such as cattle and goats, or cash crops, farmers can increase their overall productivity and reduce costs, particularly those associated with weeding and fertilizer application. Despite this, many smallholders remain unaware of the potential benefits or are hesitant to adopt such practices due to limited knowledge and resources.

This study aims to explore the factors influencing the acceptance and awareness of smallholders toward integrated farming systems in Malaysia. Understanding these factors is essential for promoting widespread adoption and helping smallholders overcome the challenges they face. Specifically, the objectives of the study are:

1. To identify the most influential factors guiding smallholders' decisions to adopt integrated farming systems in oil palm plantations.
2. To determine the relationship between various factors (such as increased yield, income maximization, cost reduction, improved soil fertility, and reduced economic risk) and smallholder acceptance of integrated farming systems.

This research is particularly significant as it addresses the knowledge gap concerning the low adoption rates of integrated farming systems. By identifying the main drivers of acceptance, the study aims to provide insights that can guide policymakers and agricultural agencies in developing more targeted and effective strategies to support smallholders. Furthermore, with increasing concerns about environmental sustainability and economic stability in the agricultural sector, integrated farming presents a promising solution to enhance productivity while promoting resource efficiency and reducing dependency on external inputs.

Methodology

Conceptual Framework

Based on prior studies the following conceptual model has been developed to illustrate the influence of yield enhancement, income optimization, productivity addition, cost minimization and risk mitigation on smallholders acceptance and awareness towards integrated farming (Figure 1)

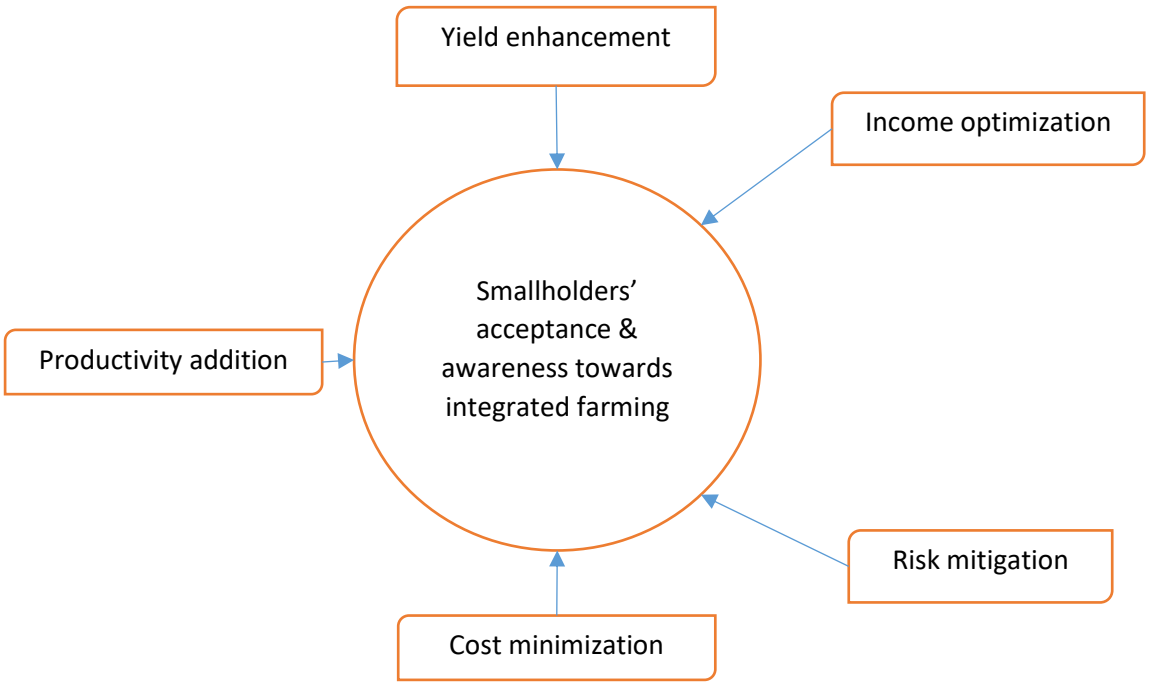

Figure 1: Conceptual framework of elements that influencing OER and KER

This study utilized a quantitative research design to examine the acceptance and awareness of integrated farming systems among oil palm smallholders in Malaysia. The research methodology consisted of several stages, including the selection of the study area, sampling techniques, data collection methods, and the analysis of the data.

Study Area

The research was conducted in Keratong Rompin, located in the state of Pahang, Malaysia. Keratong was chosen as the study site due to its significant population of smallholders engaged in oil palm farming. The location is also representative of the agricultural challenges faced by smallholders across Malaysia, particularly the reliance on monoculture farming practices and limited integration with livestock or other cash crops.

Sampling Technique and Population

The target population for this study comprised oil palm smallholders in Keratong Rompin Pahang. A sample size of 160 smallholders was selected for the study. The sampling method used was random sampling, ensuring that the sample was representative of the smallholder population in the region. The smallholders were randomly selected from the total population, which includes individuals with varying levels of experience in oil palm farming, different land sizes, and different levels of education.

The Krejcie and Morgan (1970) sample size determination table was used to calculate an appropriate sample size for the study, given the total smallholder population in Keratong Pahang. A sample size of 160 was deemed adequate for reliable statistical analysis.

Data Collection Methods

The data for this study were collected using structured questionnaires. The questionnaire was designed in two sections:

Section A: Demographic Information – This section gathered information about the respondents' personal characteristics, including gender, age, education level, size of landholding, and farming experience. This demographic data was essential for understanding the context of smallholder decision-making.

Section B: Factors Influencing Acceptance of Integrated Farming – This section used a Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree) to measure respondents' perceptions of the factors influencing their acceptance and awareness of integrated farming systems.

The questionnaire was pre-tested to ensure clarity and reliability. It was distributed to the 160 smallholders by trained enumerators who conducted on-the-spot interviews to ensure accurate data collection and to address any misunderstandings in real-time.

Data Analysis

The data collected were analyzed using SPSS (Statistical Package for the Social Sciences) software. Several analytical methods were applied to address the research objectives:

Descriptive Analysis: Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize the demographic characteristics of the respondents and their responses to the questionnaire items. This helped in understanding the general profile of the smallholders and their attitudes toward integrated farming.

Reliability Analysis: A reliability test (Cronbach's Alpha) was conducted to ensure that the Likert scale used in the questionnaire was reliable and that the factors measured were internally consistent. A Cronbach's Alpha value of 0.7 or higher was considered acceptable for this study.

Pearson Correlation Analysis: Pearson correlation analysis was employed to explore the relationships between the independent variables (yield, income, productivity, cost reduction and risk reduction) and the dependent variable (acceptance of integrated farming). This helped identify the strength and direction of the relationships between these factors.

Regression Analysis: Multiple regression analysis was used to determine the impact of each factor on the acceptance of integrated farming. The regression model allowed the study to quantify how much each factor contributed to the smallholders' decision to adopt integrated farming systems.

Ethical Considerations

The study ensured that ethical standards were maintained throughout the research process. Informed consent was obtained from all respondents, and they were assured that their responses would remain anonymous and confidential. Participation in the study was voluntary, and the respondents were free to withdraw at any time without any repercussions.

Location

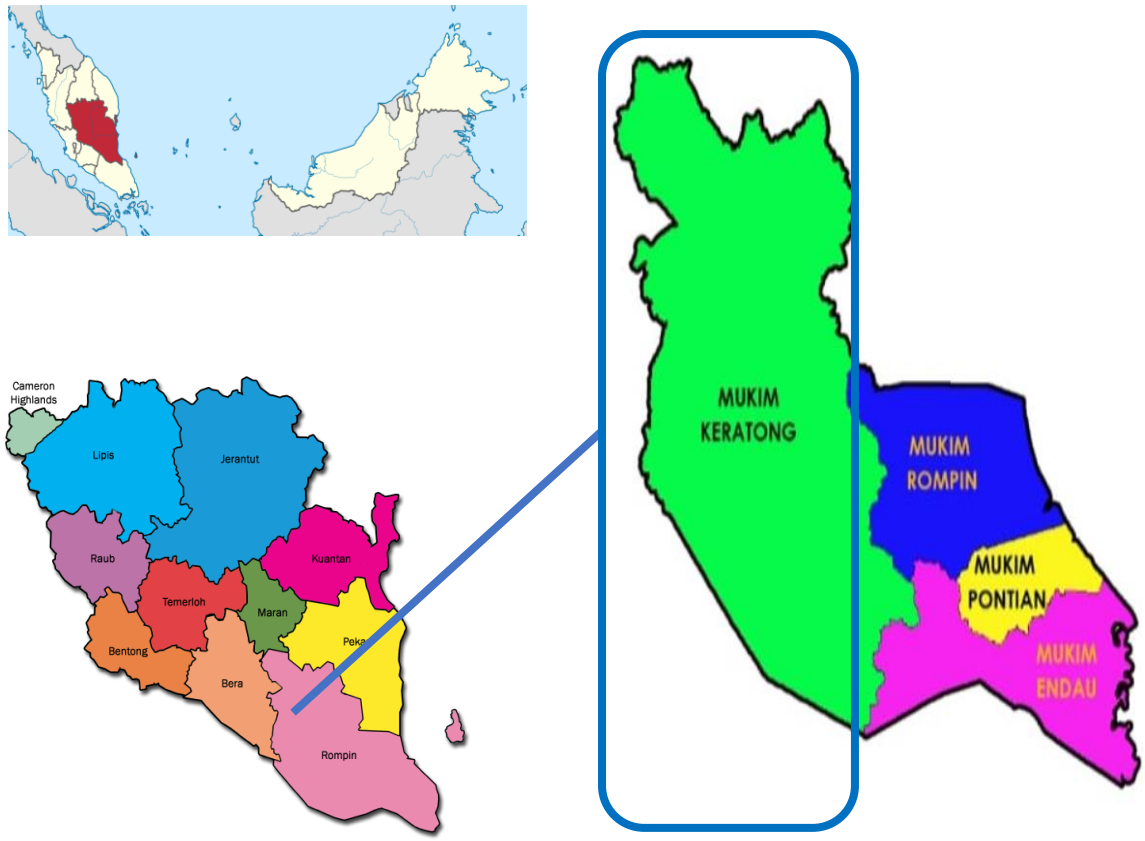

Figure 2: Location of study

Results and Discussion

The results of this study provide insights into the demographic characteristics of oil palm smallholders, their level of awareness regarding integrated farming, and the factors influencing their acceptance of such systems. The data analysis involved descriptive statistics, Pearson correlation analysis, and multiple regression analysis to address the research objectives.

Demographic Profile of Respondents

The demographic profile of the 160 smallholders who participated in this study is summarized in the tables below:

Table 1
Biographical information of respondents

Demographic variables	Response categories	%
Gender	Male	96
	female	4
Age (years)	20 – 30	7
	31- 40	35
	41- 50	36
	More than 50	22
Marital Status	Single	14
	married	86
Integration	Oil palm only	63
	Oil palm + livestock	20
	Oil palm + cash crop	17
Educational Level	Primary school	31
	Secondary school	61
	Diploma	4
	Degree	4
Income	Less than RM1000	20
	RM1,001 - RM2,000	56
	RM2,001 - RM3,000	20
	More than RM3,001	4
Working experience	Below 5 years	40
	6-10 years	37
	Above 11	23
Palm area (ha)	Below 5 ha	64
	More than 5 ha	36
Stand per hectare	128	36
	136	52
	148	11
	168	1

Most of the respondents were male (96%), reflecting the dominance of men in the oil palm farming industry. The respondents were between 41 and 50 years old (35%), followed by those aged 31 to 40 years (34%). Only 7% of the respondents were aged 21 to 30, indicating that younger generations are less involved in oil palm farming.The educational background of

the smallholders was relatively low, with 61% having only completed secondary school. About 15% had only primary education, while 7% had attained a college or university degree.The majority of smallholders owned less than 5 hectares of land (64%), while the rest owned between 6 and 10 hectares (36%). No smallholder owned more than 10 hectares, reflecting the limited scale of individual oil palm farming operations in the area. Only 37.4% of smallholders had adopted some form of integrated farming (either with livestock or cash crops), while the majority (64%) continued to practice monoculture oil palm farming. This indicates that integrated farming remains underutilized among the respondents. Only 37.4% of respondents had adopted integrated farming, indicating that many smallholders were either unaware of its potential benefits or were hesitant to implement it. Among those who practiced integrated farming: 20% practiced integration with livestock, primarily cattle. 17% integrated their oil palm farming with cash crops such as bananas and pineapples.

Pearson Correlation Analysis

The correlation analysis revealed several key relationships between the independent variables and the acceptance of integrated farming systems:

Yield enhancement: A strong positive correlation was found between increased yield and acceptance of integrated farming ($r = 0.679$, $p < 0.01$). Smallholders who believed that integrating oil palm with livestock or cash crops would increase their yield were more likely to adopt the practice.

Income optimization: There was a large positive correlation between income maximization and acceptance ($r = 0.560$, $p < 0.01$). Farmers who saw the potential for increased income from integrated farming were more willing to adopt the system. This income was derived from diversified sources, such as livestock and cash crops, in addition to oil palm.

Cost minimization: Cost reduction had a large positive relationship with acceptance ($r = 0.569$, $p < 0.01$). Smallholders recognized that integrated farming, particularly with livestock, could reduce weeding and fertilizer costs, which made the system more attractive to them.

Risk mitigation: The correlation between risk mitigation and acceptance was medium ($r = 0.486$, $p < 0.01$). Respondents indicated that integrating farming with livestock or cash crops helped reduce economic risk by diversifying income sources.

Productivity Addition: There was a medium correlation between increased productivity and acceptance ($r = 0.388$, $p < 0.01$), suggesting that while productivity gains are important, they may not be the primary motivator for adopting integrated farming.

From table 2 below, as we can have interpreted are this table indicated the relationship between independent variables and dependent variables. The direction of relationships among variables is another issue that should be considered in analysing the correlations between variables. A positive correlation indicates that the direction of the relationship is positive (if one increases, the other one increases). Bivariate Correlations are used to know the nature, direction, and significance of the bivariate relationship of the variables of this study. Therefore, the Bivariate Correlations procedures have used to compute Pearson's correlation coefficient. A rule of thumb is that multicollinearity may be a problem if a

correlation is >. 90, in the correlation matrix formed by all the independent variables (Coakes S. J. and L. G. Steed, 2000).

Table 2
Correlation value Interpreted according to Cohen 1988

Correlation Value	Effect Size value
0.7	Very large
0.5	Large
0.3	Medium
0.1	Small

Regression
A multiple regression analysis was conducted to assess the relative importance of the different factors influencing acceptance of integrated farming systems. The results showed that the model explained 50.8% of the variance in acceptance (R^2 = 0.508). The most influential factors were as follows:

Yield enhancement: This was the most significant predictor of acceptance (β = 0.447, p = 0.013), confirming that smallholders prioritize higher yields when considering integrated farming systems.

Income optimization: Income was also a significant factor (β = 0.272, p = 0.018), demonstrating that financial benefits play a crucial role in smallholders' decision-making.

Cost minimization: This factor had a significant positive influence (β = 0.376, p = 0.019), showing that reducing operational costs, particularly for weed control, is a strong incentive for adopting integrated systems.

Productivity addition: While productivity showed a weaker influence on acceptance (β = -0.383, p = 0.022), it still had a statistically significant impact.

Conclusion
This study provides important insights into the factors influencing the acceptance and awareness of integrated farming systems among oil palm smallholders in Malaysia. The findings indicate that increased yield, maximized income, and cost reduction are the most significant drivers encouraging smallholders to adopt integrated farming practices. Smallholders who recognize that integrating livestock or cash crops with oil palm plantations can increase yields and income are more likely to accept the system. Additionally, the potential for reducing operational costs, particularly in weed management, strengthens the case for integrated farming.

Despite these benefits, the adoption of integrated farming remains low among smallholders due to low levels of awareness and limited technical knowledge. Many smallholders are either unaware of the economic and environmental advantages or are hesitant to transition away from the familiar practice of monoculture. The study highlights the need for more effective

awareness campaigns and hands-on training programs to bridge this knowledge gap and encourage broader adoption of integrated farming.

The role of government agencies, particularly the Malaysian Palm Oil Board (MPOB), is crucial in promoting integrated farming systems. There is a need for greater collaboration between government bodies, research institutions, and local farmer organizations to ensure that smallholders are provided with the resources, knowledge, and technical assistance they need to implement integrated systems successfully.

The economic and environmental benefits of integrated farming are clear, with improved soil fertility, lower dependency on chemical inputs, and diversified income sources contributing to the sustainability and resilience of smallholder farming. However, addressing the barriers to adoption, such as financial constraints and labor concerns, will be key to achieving wider implementation. In conclusion, while integrated farming systems offer significant potential for improving smallholder livelihoods and ensuring agricultural sustainability, targeted efforts must be made to promote their adoption. By addressing the existing barriers, Malaysia can move toward a more resilient and diversified agricultural sector.

This research contributes significantly to both theoretical understanding and practical application within the domain of integrated farming systems. Theoretically, it extends the existing body of knowledge on smallholder acceptance of sustainable agricultural practices by providing a deeper understanding of the factors influencing their decision-making processes. By integrating concepts from yield enhancement, income optimization, and cost minimization into a cohesive framework, this study offers a novel model for predicting smallholder behavior in adopting integrated farming systems, particularly in oil palm plantations. The findings also challenge and refine existing theories that have traditionally focused on monoculture practices by demonstrating the added value of diversified farming systems in enhancing economic resilience and reducing risks for smallholders.

Contextually, this research fills a critical knowledge gap specific to the Malaysian agricultural landscape, particularly in the region of Keratong, Pahang. The study highlights the unique challenges and opportunities faced by smallholders in adopting integrated farming within the oil palm sector, emphasizing the role of local awareness, governmental support, and economic incentives. Furthermore, the insights gained from this study provide practical implications for policymakers, the Malaysian Palm Oil Board (MPOB), and agricultural agencies to tailor more effective outreach, training, and financial programs that address the specific needs and barriers identified among smallholders in this region. As such, the research not only contributes to the global discourse on sustainable agriculture but also offers context-specific solutions aimed at improving the livelihood and sustainability of oil palm smallholders in Malaysia.

Recommendations

Based on the findings of this study, the following recommendations are proposed to encourage the adoption of integrated farming systems among oil palm smallholders:

Increase Awareness and Education: Agricultural agencies like MPOB should prioritize awareness campaigns that clearly explain the benefits of integrated farming systems. These

campaigns should use real-world examples and success stories to demonstrate the positive impacts on yield, income, and cost reduction.

Provide Technical Training and Support: Government bodies, in collaboration with educational institutions, should offer comprehensive training programs for smallholders. These programs should focus on the practical aspects of integrating livestock and cash crops with oil palm, with a particular emphasis on improving smallholders' technical skills and knowledge.

Offer Financial Incentives: Financial incentives, such as subsidies, grants, or low-interest loans, should be made available to help smallholders cover the initial costs of adopting integrated farming systems. These incentives would help reduce the financial burden, making it easier for smallholders to invest in infrastructure and resources needed for integration.

Encourage Cooperative Learning and Peer-to-Peer Knowledge Sharing: Smallholders could benefit from cooperative learning environments, where experienced farmers share their knowledge with others. Agricultural cooperatives or local farming groups can play a key role in facilitating this exchange of information and creating a supportive community for farmers interested in adopting integrated farming.

Enhance Research and Development Efforts: Continuous research should focus on improving integrated farming systems to make them more efficient and less labor-intensive. Research institutions should explore the best combinations of livestock and crops for specific regions, as well as ways to optimize productivity while reducing costs and labor demands.

By implementing these recommendations, government agencies and agricultural stakeholders can help smallholders transition to integrated farming systems, thereby enhancing both the economic and environmental sustainability of Malaysia’s agricultural sector.

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