



# The Effects Of Attitudes Towards Sustainability And Market Pressure On Smallholders' Readiness Towards Sustainability Certification Implementation

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## ARTICLE INFO

## ABSTRACT

**Objective:** This paper aims to investigate into the underexplored ground of market pressure and its relationship with attitudes toward sustainability certification among palm oil smallholders. Furthermore, it analyses the moderating role of market pressure in explaining the relationship between sustainability attitudes and the readiness to embark on sustainability certification among palm oil smallholders. Employing a quantitative research design, data were gathered from a randomized sample of 408 smallholders through the distribution of structured questionnaires. These data were subsequently subjected to rigorous analysis utilizing Partial Least Squares Structural Equation Modelling (PLS-SEM) to validate the research hypotheses. The research findings unveil the pivotal influence of market pressure on individuals' attitudes toward sustainability within the context of palm oil smallholders. Additionally, market pressure emerges as a significant catalyst in fostering readiness among smallholders to implement sustainability certification. The study thereby highlights the significance of market dynamics and their potential to influence smallholders' sustainability perspectives. This study extends the research understanding of the complex dynamics between sustainability attitudes, market pressure, and the readiness of smallholders to embark on the journey toward sustainability certification. By tapping into the awareness and knowledge of smallholders concerning market pressures, policymakers and industry stakeholders can cultivate a more conducive environment for the adoption of sustainability practices within the palm oil industry. The research contributes significantly to the existing literature on attitudes toward sustainability, market pressure, and the readiness for implementing sustainability certification. Its findings emphasize the critical role played by market forces in shaping the sustainability landscape among palm oil smallholders, paving the way for informed policy interventions and industry practices.

**Keywords:** Smallholders; Market Pressure; Readiness; Sustainability Certification; Attitudes towards sustainability

## 1. INTRODUCTION

Malaysia, gifted with abundant natural resources encompassing agriculture, forestry, and mining, has historically thrived in its commodities sector, notwithstanding a transition towards manufacturing during the 1980s and 1990s. An important component of Malaysia's commodities portfolio is palm oil, with the country being the world's second-largest producer and exporter after Indonesia, commanding 11% of global oils and 27% of foreign trade.

The palm oil industry serves as a vital economic lifeline for over 3 million smallholders globally, with Malaysia alone employing more than half a million individuals and supporting an additional million. Smallholders, constituting 40% of global palm oil production, are central to fostering sustainability within the sector. Improving smallholder engagement is essential for achieving poverty eradication and sustainable palm oil supply chains. A considerable amount of evidence has demonstrated the challenges of engaging palm oil smallholders in sustainability.

In Malaysia, smallholders are classified as either independent or organized, with the former managing less than 40.46 hectares of oil palm land individually or with minimal assistance. As of December 2018, Malaysia boasted 255,615 independent smallholders overseeing 994,022 hectares, accounting for 17% of the nation's total oil palm planted area (Kushairi et al., 2019). This shows that smallholders make a significant contribution to global production and crop area (Nagiah & Azmi, 2012). Research suggests that palm oil plantations span over 27 million hectares of land worldwide.

The palm oil industry has significant influence over environmental sustainability, mostly due to factors such as deforestation, loss of biodiversity, and escalating greenhouse gas emissions (RSPCA Australia, n.d). Moreover, its impact on food security is profound, given that a staggering 85% of palm oil application is in food products (Hariyadi, 2020). As concerns for both food safety and environmental sustainability intensify, there is a notable trend towards adopting agriculturally responsible practices (Rahmat et al., 2022). This highlights the need for significant changes within the agricultural sector, particularly under heightened scrutiny from consumers and environmental advocates (Litja, 2020).

This shift to responsible agricultural practices for palm oil products in the global value chain has resulted in restrictions for exports to the EU market imposed on palm oil products deemed unsustainable or lacking sustainability certification. This poses significant challenges to Asian exporters like Malaysia and Indonesia, particularly given the substantial number of smallholders who are hesitant to pursue sustainability certifications (Ahmad Rizal & Md Nordin, 2022b).

This growing demand for sustainably produced palm oil products in the global market and concerns on the environmental and social impacts of palm oil production led to the establishment of the Roundtable on Sustainable Palm Oil (RSPO) and Malaysian Sustainable Palm Oil (MSPO) certification standard by the Malaysian Palm Oil Board (MPOB). MSPO especially is aimed at addressing these sustainability concerns particularly among medium producers and smallholders in Malaysia (Senawi et al., 2019; Shahida et al., 2019). There is a need to assist smallholders in meeting international and national standards for oil palm cultivation while diversifying their livelihoods (Mohd Noor et al., 2017). Smallholders are observed to face constant struggle in considering certification which leads to hesitancy and reluctance. Especially with their limited technical and financial capabilities impede their ability to meet the strict standards required for certification compliance (Ogahara et al., 2022a; Ahmad Rizal & Nordin, 2022a). In addition, consistently low incomes and yields create formidable obstacles that also hinder their socio-economic progress (Ogahara et al., 2022b). The lack of comprehensive understanding among smallholders regarding the complexities of certification and environmentally responsible palm oil production also adds to their reluctance towards certification (Pramudya et al., 2022). Despite efforts to implement certification standards aimed at mitigating these challenges, it continues to affect the sustainability and profitability of smallholder operations (Ogahara et al., 2022b). The repercussions of this reluctance extend to the livelihoods of smallholders, impacting their ability to sell their products and resulting in significant economic losses. Consequently, this market access emerges as a crucial incentive for smallholders to pursue sustainable certification (Morgan, 2023; Ahmad Rizal & Nordin, 2022a; RSPO, 2023).

In light of these challenges and opportunities, this paper seeks to investigate deeper into the dynamics of smallholder palm oil production in Malaysia, analysing the factors influencing their readiness towards sustainability certification and practices implementation, livelihoods, and the broader implications for the palm oil industry and sustainable development goals.

## 2. LITERATURE REVIEW

### 2.1 Attitudes Towards Sustainability

Palm oil sustainability certification refers to the process by which smallholder farmers and companies adopt sustainable practices to meet global demand for environmentally friendly palm oil. The most well-known certification schemes include the Roundtable on Sustainable Palm Oil (RSPO), the Indonesian Sustainable Palm Oil (ISPO) Foundation, and the Malaysian Sustainable Palm Oil (MSPO) Certification Scheme (Certified Sustainable Palm Oil, n.d.).

Certification is a response to international market pressures that require producers of agricultural commodities to comply with sustainability standards and avoid penalties. (Apriani et al., 2020). Consumer preferences for environmentally friendly products and willingness to pay premiums for sustainability further emphasize the influence of market dynamics on sustainable practices (Chekima et al., 2016). These certification fosters organizational and technological innovations among smallholders, enhancing production quality, and reducing negative environmental impacts through safe and limited use of chemical fertilizers and herbicides (Iverson & Dervan, 2023). Certification also leads to better management practices, increasing yields and oil extraction

rates, thus improving smallholders' incomes while reducing negative environmental impacts (Certified Sustainable Palm Oil, n.d.).

Furthermore, the presence of certification may enhance a company's reputation, fostering trust and loyalty among consumers. The economic model presented in the Yalabik and Fairchild (2011) paper suggests that environmental pressures, including certification, are more effective in driving environmental innovation and investments when companies operate below a certain emissions threshold and when there is competition for environmentally sensitive customers. Therefore, in competitive markets, certification is not merely a marketing tool but also a reflection of a company's strategic adaptation to external pressures demanding environmental responsibility (Yalabik & Fairchild, 2011). Zhu and Sarkis (2007) describe that customer pressure moderates the relationship between sustainability practices and outcome, highlighting the economic implications of sustainability performance.

Smallholders attitudes towards sustainability practices are important in shaping the future of agricultural landscapes and can vary depending on several factors (Smith & Jones, 2023). It includes their perception of the benefits of sustainability certification, their awareness of the challenges and costs of certification, and their social structures. Some smallholders may be hesitant to participate in sustainable certification due to challenges such as limited resources, low awareness, and the perceived costs of certification, while others may recognize the potential benefits, such as improved market access, better prices, and access to training and assistance. The decision-making process of smallholders regarding sustainability certification can be guided by a cost-benefit analysis, considering factors such as improved access to markets, enhanced relations with mills, increased productivity, reduced negative environmental impacts, and access to financial support and technical assistance. Additionally, social structures, such as social interaction ties, deliberative communication, and responsible leadership, can play a significant role in smallholders' participation in sustainable certification.

Some smallholders may be hesitant and reluctant to adopt certification due to limited technical and financial resources, low yields, lack of knowledge, high costs, and requirements regarding group organization and land legality (Saadun et al., 2018; Ahmad Rizal & Nordin, 2022a; De Vos et al., 2021). However, other smallholders may see the benefits of certification, such as improved relations with mills, better prices, access to training and assistance, and access to financial support and technical assistance (De Vos et al., 2021; Ahmad Rizal & Nordin, 2022b). Therefore, smallholders' attitudes towards sustainability certification are influenced by a complex interplay of challenges, potential benefits, and the social structures that surround them.

## **2.2 Readiness to Implement Certification**

Readiness to implement certification refers to the preparedness of smallholders to adopt sustainability certification. As sustainability certification has emerged as an important consideration for smallholders, the decision-making process of smallholder regarding sustainability certification can be guided by a cost-benefit analysis. This involves evaluating the costs and benefits of certification to make an informed decision. Rational Choice Theory (RCT) offers insights into how smallholders weigh the benefits of certification against associated costs, ultimately opting for compliance when the benefits outweigh the expenditures (Gillespie, 2012).

This rational decision-making highlights the importance of attitudes towards sustainability and market pressures in shaping smallholders' readiness to implement certification. The cost-benefit analysis takes into account factors such as the costs associated with certification such as the cost of repeated audits, the potential loss of income during the certification process, the potential increase in productivity, the reduction of negative environmental impacts, access to financial support and the potential benefits of certification, such as greater market access, good, better prices, and access to training and assistance (Hidayat et al., 2015; Ahmad Rizal & Nordin, 2022b; De Vos et al., 2021). By weighing these costs and benefits, smallholders can make a rational decision about whether to pursue sustainability certification, taking into account the potential long-term advantages and the support available from various stakeholders, including government, NGOs, and the private sector (Anh et al., 2019; IDH The Sustainable Trade Initiative, 2013; Food and Agriculture Organization, 2023; Peteru et al., 2022; Nygaard, 2023).

However, the decision-making process goes beyond mere cost-benefit analysis. Social structure plays an important role, in influencing the perception and choice of smallholders regarding sustainability certification. Factors such as social interaction relationships, communication patterns, and leadership dynamics also contribute to making informed decisions (Ahmad Rizal & Nordin, 2022a). By taking into account the needs and interests of various stakeholders, smallholders can navigate the complexity of sustainability certification more effectively. Therefore, to increase the participation of smallholders in sustainable certification, various efforts are made to raise awareness, provide financial support, and take advantage of social structures such as social interaction relationships, deliberative communication, and responsible leadership (Ahmad Rizal & Nordin, 2022b).

## **2.3 Market Pressure**

Increasing international pressure from countries with strict environmental regulations is shaping the sustainability agenda in developing countries. Where market pressure and increased demand for sustainable palm oil products encourage smallholders to adopt certification to maintain access to the market and simultaneously increase profits (Saadun et al., 2018; Lestari, 2021; Ahmad Rizal & Nordin, 2022a). In an effort

to achieve sustainability in the palm oil industry, approaches from various aspects in dealing with the social, economic and environmental dimensions are essential (Korhonen, 2001). Apart from that, government intervention, and public awareness also play an important role in driving sustainability initiatives (Arora & Gangopadhyay, 1995; Yalabik & Fairchild, 2011).

Amid these challenges, certification emerged as an important mechanism for market access and quality assurance. The shift towards certified sustainable palm oil reflects increasing consumer demand for environmentally responsible products. Certification not only signifies compliance with strict standards but also fosters organizational and technological innovation that will improve production quality. (Hidayat et al., 2015; Ahmad Rizal & Nordin, 2022a). Although certification offers indirect financial benefits, it may not significantly reduce the economic vulnerability of smallholders or increase market access.

Thus, access to profitable markets and premium prices for certified palm oil are important incentives for smallholders, as stated by Hidayat et al. (2015) and De Vos et al. (2021). In addition, smallholders must also consider the broader market landscape, including the risk of losing competitiveness if they do not adopt certification (Hidayat et al., 2015). This highlights the delicate balance between short-term financial concerns and long-term sustainability goals. In conclusion, the decision to receive sustainability certification reflects a nuanced interaction of economic, social, and environmental factors, shaped by the unique circumstances and preferences of individual smallholders (Hidayat et al., 2015; Ahmad Rizal & Nordin, 2022b). Therefore, a comprehensive understanding of these dynamics is essential to foster the widespread adoption of sustainable practices in smallholder communities.

The sustainability of oil palm smallholders has garnered considerable attention within scholarly discourse, with research emphasizing the pivotal role of policies, regulations, and sustainable practices in ensuring the viability of this critical sector. Gillespie (2012) highlights that policies and regulations must address sustainability concerns to effectively support oil palm smallholders. Building upon the existing literature, this research seeks to investigate the interplay between attitudes towards sustainability, market pressures, and readiness to implement sustainability certification among oil palm smallholders. The following hypotheses are proposed:

H1: There is a significant relationship between attitudes towards sustainability and readiness towards sustainability certification implementation.

H2: There is a significant relationship between market pressure and readiness towards sustainability certification implementation.

H3: There is significant moderating effect of market pressure on the relationship between attitudes towards sustainability and readiness towards sustainability certification implementation.

By empirically examining these hypotheses, this study aims to contribute to a deeper understanding of the factors (i.e. attitudes towards sustainability and market pressure) influencing smallholders' on implementing sustainability certification, thereby informing policy and practice interventions aimed at promoting sustainable palm oil production. Figure 1 presents the model that was constructed for this study based on the hypotheses and the previous research that was reviewed.

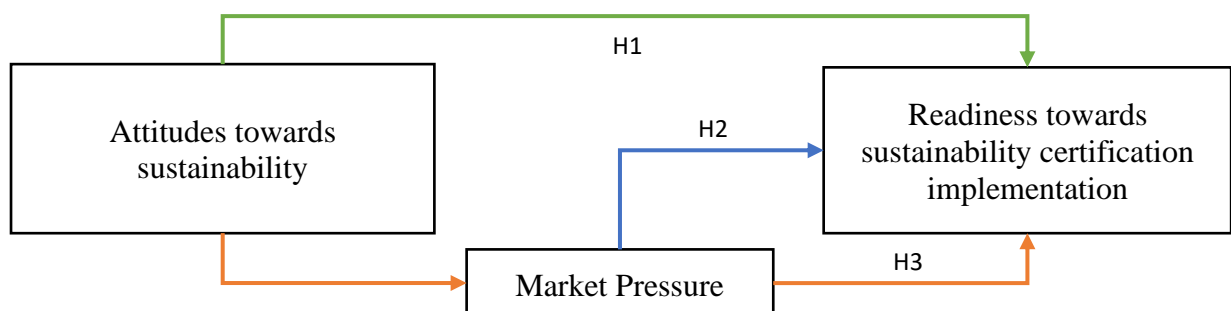


Figure 1 Conceptual framework of the study

### 3. METHODOLOGY

#### 3.1 Research Design and Instrument Development

This study employed a quantitative cross-sectional design to evaluate hypotheses regarding the factors influencing smallholders' participation in sustainable certification within the Malaysian palm oil industry. A seven-point Likert scale closed-ended questionnaire was utilized as the primary instrument for data collection. The questionnaire was meticulously designed to elicit responses from 408 Malaysian palm oil smallholders, serving as the unit of analysis. It is estimated that smallholders account for 30-40% of palm oil cultivation in Malaysia, and there were almost 250,000 licenses for smallholders in Malaysia as of December 2021. Smallholders, as defined for the purposes of this study, are landowners authorized to cultivate oil palm on parcels of land totalling less than forty (40) hectares.

The questionnaire was structured into three distinct sections: attitudes towards sustainability, market pressure and the readiness in implementing the Malaysian Sustainable Palm Oil (MSPO) principles. The attitude



towards sustainability comprises of 3 subsections namely, attitudes on environment, social and economy. Whilst market pressure comprises of 2 subsections i.e. international market pressure and market volatility. Lastly, the readiness in implementing MSPO was in section 3 where smallholders were asked their readiness based on the seven key principles of MSPO as follows:

1. Principle 1: Management Commitment - Assessing the degree of commitment demonstrated by management towards implementing MSPO.
2. Principle 2: Transparency and Traceability - Evaluating the transparency and traceability measures adopted within oil palm facilities.
3. Principle 3: Compliance with Laws and Regulations - Verifying adherence to relevant laws and regulations governing oil palm cultivation and product handling.
4. Principle 4: Social Responsibility - Assessing aspects related to societal duty, employee health and safety, and working conditions.
5. Principle 5: Environmental Considerations - Evaluating practices concerning the environment, natural resources, biodiversity, and ecosystems.
6. Principle 6: Best Management Practices - Analysing the implementation of best management practices to optimize output.
7. Principle 7: New Crop Planting - Addressing concerns regarding new crop planting in high-biodiversity zones.

### 3.2 Data Analysis

The collected data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) technique. PLS-SEM is a robust statistical method suitable for analysing complex relationships among latent variables in a structural model. The structural model of this study was constructed to test path coefficients, forecast power, relevance, and impact size of the factors influencing smallholders' readiness to implement sustainability certification.

For data analysis, SmartPLS 3 software was employed. SmartPLS 3 offers advanced capabilities for conducting PLS-SEM analyses, facilitating the examination of complex relationships, and providing insights into the structural dynamics under investigation. This comprehensive methodology framework ensures the rigorous examination of hypotheses and contributes to a deeper understanding of the factors driving smallholders' participation in sustainable certification within the Malaysian palm oil industry.

To analyse the relationship between the independent variable "Attitudes towards sustainability," the dependent variable "readiness to implement MSPO certification," and the moderating variable "market pressure," several steps were undertaken. Firstly, the measurement model was assessed to ensure the reliability and validity of the constructs. This involved examining indicator loadings, composite reliability, and average variance extracted (AVE) to ensure that the latent constructs accurately represent the observed variables.

Secondly, the structural model was evaluated to investigate the direct and indirect effects among the constructs. Path coefficients were analysed to determine the strength and significance of the relationships between "Attitudes towards sustainability" and "readiness to implement MSPO certification." Additionally, the moderating effect of "market pressure" was assessed to understand how it influences the relationship between attitudes towards sustainability and readiness to implement MSPO certification.

Moderated regression analysis (MRA) or multigroup analysis (MGA) can be conducted to test the moderation effect of "market pressure" on the relationship between attitudes towards sustainability and readiness to implement MSPO certification. This involves comparing the path coefficients and significance levels of the relationship between the two variables across different levels of "market pressure."

Furthermore, bootstrapping techniques can be employed to assess the significance of indirect effects and to obtain confidence intervals for the path coefficients. This helps in understanding the mediation effects, if any, between attitudes towards sustainability and readiness to implement MSPO certification.

Overall, through the application of PLS-SEM and SmartPLS 3 software, this study offers a comprehensive analysis of the relationships between attitudes towards sustainability, readiness to implement MSPO certification, and the moderating influence of market pressure, thereby enhancing our understanding of the factors driving smallholders' participation in sustainable certification within the Malaysian palm oil industry.

## 4. FINDINGS

In this study, the questionnaire encompassed a broad spectrum of factors vital to understanding smallholders' perspectives, ranging from demographic information to nuanced inquiries about sustainable attitudes, political stability, market pressures, and readiness for sustainability certification, providing a multifaceted exploration into the complexities of sustainable practices within the palm oil industry.

### 4.1 Demographic Profile

The demographic profile of the respondents is summarized in Table 1, providing insights into their characteristics across various demographic variables. The analysis encompasses the frequency and percentage

distribution of respondents based on their state of residence, gender, age, ethnicity, marital status, household size, income level, educational attainment, number of children, and involvement of children in palm oil farms. Table 1 reveals that the majority of respondents were from Johor, comprising 30% of the total sample, followed by Sarawak (16%) and Sabah (11%). Additionally, a significant majority of respondents were male, accounting for 87% of the sample. Regarding age distribution, more than 50% of respondents were aged above 51 years, indicating a relatively older demographic profile among palm oil smallholders participating in the study.

Marital status analysis indicates that the majority of respondents were married (93%), underscoring the familial context within which palm oil smallholders operate. In terms of household size, around two-thirds of respondents reported having 3–5 people in their households, reflecting the typical family structure prevalent among smallholder communities.

Ethnically, Malay respondents constituted the largest proportion at 55%, followed by Chinese (18%), other ethnicities (22%), and Indian (4%). Income distribution analysis highlights that the highest proportion of respondents fell within the income range of RM2001–RM3000 (32%), followed by RM1000–RM2000 (30%), suggesting a predominantly middle-income group among the surveyed smallholders.

Educational attainment analysis indicates that half of the respondents (50%) had completed high school education, while a significant proportion had attained primary or lower levels of education. Family size analysis reveals that the most common number of children among respondents was 3 (32%), followed by 4 children (20%).

Furthermore, an interesting observation is made regarding children's involvement in palm oil farms, with 58% of respondents reporting that their schooled children above 18 years old assist in farm activities. This finding underscores the intergenerational involvement and continuity of palm oil farming practices within smallholder households.

Overall, the demographic profile provides valuable insights into the characteristics of palm oil smallholders in Malaysia, shedding light on their socio-economic status, family dynamics, and involvement in agricultural activities. These findings lay the foundation for a deeper understanding of the factors influencing smallholders' readiness to engage in sustainable certification processes.

Table 1: Demographic profile of the respondents

	Frequency	Percentage
<b>State</b>		
Sabah	45	11
Sarawak	64	16
Pahang	31	8
Selangor	18	4
Melaka	6	1
Johor	124	30
Negeri Sembilan	12	3
Perak	36	9
Kedah	9	2
Pulau Pinang	12	3
Perlis	10	2
Kelantan	8	2
Terengganu	33	8
<b>Gender</b>		
Male	355	87
Female	53	13
<b>Age</b>		
18-30	17	4
31-40	69	17
41-50	110	27
51-60	137	34
Above 61	75	18
<b>Ethnic</b>		
Malay	227	56
Chinese	73	18
Indian	17	4
Others	91	22
<b>Status</b>		
Single	19	5
Married	381	93
Divorced/ Widowed	8	2
<b>Number of Household</b>		
Less than 2	40	10

<b>3 -5</b>	274	67
<b>6 - 10</b>	89	22
<b>More than 11</b>	5	1
<b>Household income</b>		
<b>Less than RM1000</b>	31	7
<b>RM1001 – RM2000</b>	121	30
<b>RM2001 – RM3000</b>	130	32
<b>RM3001 – RM4000</b>	68	17
<b>RM4001 – RM5000</b>	33	8
<b>More than RM5001</b>	25	6
<b>Education</b>		
<b>No formal education</b>	14	3
<b>Primary school</b>	78	19
<b>High school</b>	204	50
<b>Certificate</b>	42	10
<b>Diploma</b>	47	12
<b>Undergraduate</b>	3	1
<b>Postgraduate</b>	20	5
<b>Number of children</b>		
<b>1</b>	24	6
<b>2</b>	64	16
<b>3</b>	131	32
<b>4</b>	82	20
<b>5</b>	60	15
<b>More than 6</b>	47	11
<b>Number of children involved in palm oil farm</b>		
<b>1</b>	17	4.2
<b>2</b>	47	11.5
<b>3</b>	117	28.7
<b>4</b>	42	10.3
<b>5</b>	32	7.9
<b>More than 6</b>	30	7.4
<b>None</b>	123	30
<b>Number of schooled children works in palm oil farm</b>		
<b>Age under 15 years old</b>	16	4
<b>Age 16 – 18 years old</b>	34	8
<b>Age above 18 years old</b>	235	58
<b>None</b>	123	30

Source: Author's primary survey

#### 4.2 Assessment of Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) is a powerful statistical technique widely employed across various disciplines, including psychology, social science, and strategic management, to analyse complex relationships among variables (Chin et al., 2008). SEM integrates factor analysis and multiple regression techniques to assess both the theoretical and measurement model structural characteristics, allowing researchers to examine intricate causal pathways and interactions among latent variables (Weston & Gore, 2006).

In this study, SEM is utilized to analyse the relationships between smallholders' sustainable attitudes, market pressure, and readiness to implement sustainability certification. The analysis involves examining the measurement model, which assesses the reliability and validity of the constructs utilized in the study.

Based on the results presented in Table 2, the internal consistency and convergent validity of the measurement model were thoroughly evaluated. Cronbach's alpha coefficients and composite reliability (CR) scores were calculated to assess the internal consistency of the constructs. The values obtained for all constructs exceeded the threshold of 0.70, indicating satisfactory reliability (Hair et al., 2017). For instance, constructs such as "BP" (Business Practices), "CLR" (Corporate Leadership), "ECO" (Economic Practices), "ENV" (Environmental Practices), "IMP" (Implementation), "MRC" (Market Pressure), "MT" (Market Trends), "NDP" (National Development Policies), "SOC" (Social Practices), "SSW" (Stakeholder Satisfaction and Well-being), and "TRA" (Transparency) demonstrated robust internal consistency, with Cronbach's alpha coefficients ranging from 0.793 to 0.957 and CR values ranging from 0.888 to 0.963. These results affirm that the items within each construct consistently measure the underlying concept, ensuring the reliability of the measurement instrument.

Furthermore, convergent validity was assessed using the average variance extracted (AVE) values, which measure the proportion of variance captured by the construct's indicators. AVE values above 0.50 indicate adequate convergent validity (Hair et al., 2017). In our analysis, all constructs exhibited satisfactory convergent

validity, with AVE values ranging from 0.519 to 0.868, surpassing the recommended threshold. For example, constructs such as "IMP" (Implementation) and "SOC" (Social Practices) demonstrated the highest levels of convergent validity, with AVE values of 0.868 and 0.781, respectively. These findings confirm that the items within each construct converge sufficiently to measure the intended construct, thus supporting the validity of the measurement model.

Additionally, discriminant validity was examined by comparing the square root of AVE for each construct with the correlations between constructs (Fornell & Larcker, 1981). The square root of AVE for each construct exceeded the correlations between constructs, providing evidence of discriminant validity. This indicates that each construct is distinct from others, supporting the interpretation of unique variance captured by each construct (Hair et al., 2017). Therefore, the results of this analysis suggest that the measurement model exhibits robust internal consistency, convergent validity, and discriminant validity, thus providing a reliable and valid tool for assessing sustainable practices within the palm oil industry.

Upon completion of the measurement model assessment, subsequent analyses will involve evaluating the structural model, examining the relationships between latent variables and testing the hypothesized paths using path coefficients and bootstrapping techniques. In summary, SEM serves as a robust analytical tool for unravelling the complex interplay between variables in the context of smallholders' readiness to implement sustainability certification. By assessing both the measurement and structural models, this analysis aims to provide a comprehensive understanding of the factors influencing smallholders' adoption of sustainable practices within the palm oil industry.

Table 2: Internal consistency and convergence validity results

<b>Constructs</b>	<b>Items</b>	<b>F.L</b>	<b>CA</b>	<b>CR</b>	<b>AVE</b>				
<b>BP</b>	BP1	0.818	<b>0.916</b>	<b>0.930</b>	<b>0.548</b>				
	BP11	0.674							
	BP12	0.630							
	BP13	0.682							
	BP14	0.685							
	BP15	0.665							
	BP2	0.852							
	BP3	0.749							
	BP4	0.762							
	BP5	0.792							
	BP6	0.797							
	<b>CLR</b>	CLR1				0.919	<b>0.913</b>	<b>0.938</b>	<b>0.757</b>
		CLR2				0.937			
CLR3		0.941							
CLR4		0.896							
CLR5		0.608							
<b>ECO</b>	ECO1	0.803	<b>0.946</b>	<b>0.957</b>	<b>0.788</b>				
	ECO2	0.914							
	ECO3	0.902							
	ECO4	0.921							
	ECO5	0.898							
	ECO6	0.884							
<b>ENB</b>	ENB1	0.832	<b>0.951</b>	<b>0.956</b>	<b>0.579</b>				
	ENB10	0.802							
	ENB11	0.827							
	ENB12	0.808							
	ENB13	0.764							
	ENB14	0.787							
	ENB16	0.814							
	ENB2	0.833							
	ENB24	0.634							
	ENB25	0.684							
	ENB26	0.641							
	ENB27	0.665							
	ENB3	0.825							
	ENB7	0.685							
	ENB8	0.764							
	ENB9	0.759							
	<b>ENV</b>	ENV1				0.887	<b>0.948</b>	<b>0.958</b>	<b>0.744</b>
ENV2		0.932							



	ENV3	0.938			
	ENV4	0.930			
	ENV5	0.905			
	ENV6	0.611			
	ENV7	0.739			
	ENV8	0.904			
<b>IMP</b>	IMP1	0.937	<b>0.949</b>	<b>0.963</b>	<b>0.868</b>
	IMP2	0.967			
	IMP3	0.935			
	IMP4	0.885			
<b>MRC</b>	MRC10	0.855	<b>0.893</b>	<b>0.921</b>	<b>0.574</b>
	MRC11	0.875			
	MRC12	0.873			
	MRC13	0.857			
	MRC14	0.857			
	MRC2	0.796			
	MRC3	0.746			
	MRC9	0.874			
	MRC1	0.790			
<b>MT</b>	MT1	0.904	<b>0.891</b>	<b>0.917</b>	<b>0.650</b>
	MT2	0.716			
	MT3	0.823			
	MT4	0.746			
	MT5	0.827			
	MT6	0.809			
<b>NDP</b>	NDP1	0.806	<b>0.849</b>	<b>0.888</b>	<b>0.519</b>
	NDP3	0.698			
	NDP4	0.772			
	NDP5	0.801			
	NDP6	0.755			
	NDP7	0.744			
	NDP8	0.797			
<b>SOC</b>	SOC1	0.866	<b>0.959</b>	<b>0.966</b>	<b>0.781</b>
	SOC2	0.919			
	SOC3	0.913			
	SOC4	0.908			
	SOC5	0.919			
	SOC6	0.890			
	SOC7	0.895			
	SOC8	0.747			
<b>SSW</b>	SSW10	0.783	<b>0.956</b>	<b>0.962</b>	<b>0.638</b>
	SSW11	0.838			
	SSW12	0.816			
	SSW15	0.894			
	SSW16	0.899			
	SSW17	0.824			
	SSW18	0.896			
	SSW19	0.889			
	SSW2	0.394			
	SSW20	0.846			
	SSW21	0.884			
	SSW32	0.564			
	SSW34	0.627			
	SSW8	0.820			
	SSW9	0.817			
<b>TRA</b>	TRA1	0.862	<b>0.957</b>	<b>0.964</b>	<b>0.710</b>
	TRA10	0.881			
	TRA11	0.886			
	TRA2	0.879			
	TRA3	0.544			
	TRA4	0.793			

	TRA5	0.814		
	TRA6	0.865		
	TRA7	0.879		
	TRA8	0.904		
	TRA9	0.898		

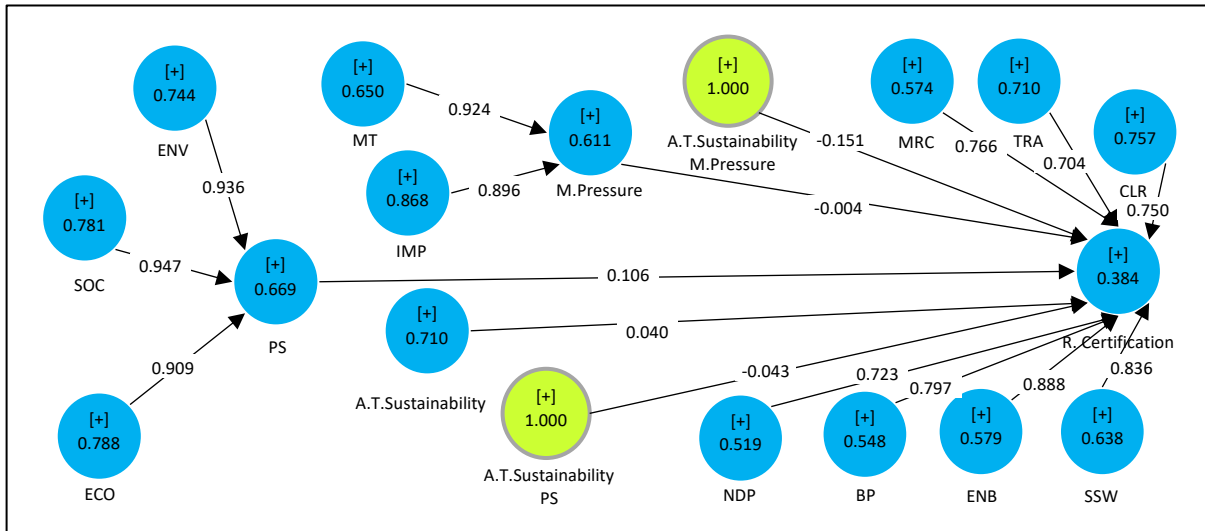


Figure 2: Presented the factor loadings/outer loadings and AVE of all latent variables calculated through PLS-Algorithm.

**4.3 Assessment of the structural model**

After validating the measurement model, the structural model is assessed to evaluate the relationships between latent constructs. The structural model comprises a sequence of structural equations that delineate the inner path model, providing insights into the causal relationships among variables (Chin, 2010). In this study, various metrics including path coefficients ( $\beta$ ), the coefficient of determination ( $R^2$ ), effect size ( $f^2$ ), multicollinearity (inner VIF), and predictive relevance ( $Q^2$ ) are utilized to evaluate the structural model (Gotz et al., 2010).

**4.3.1 Variables Relationship**

The coefficient of determination ( $R^2$ ) measures the proportion of variance in the dependent variable (readiness to implement MSPO certification) that is explained by the independent variable (attitudes towards sustainability) and any other predictors in the model. It indicates how well the independent variables explain the variability of the dependent variable. Table 3 presents the  $R^2$  findings, with the  $R^2$  value for Readiness To Implement MSPO Certification being 0.600. According to Cohen (1988), an  $R^2$  value above 25% indicates a respectable level of prediction in empirical research, suggesting that the model explains a large portion of the variance in Readiness To Implement MSPO Certification.

Table 3: R-square result

Endogenous Variable	R Square	R Square Adjusted
R.Certification	0.600	0.586

Substantial > 0.25; Moderate > 0.12, Weak > 0.02 (Cohen, 1989)

**4.3.2 Strength of Relationship Measure**

Effect size ( $f^2$ ) measures the magnitude of the relationship between predictor constructs and endogenous variables. The F-square value of 0.008 for "Attitudes towards Sustainability" in Table 4 suggests a very small effect size. This indicates that only a negligible proportion of the variance in "R.Certification" is explained by "Attitudes towards Sustainability." According to Cohen's guidelines, an effect size below 0.01 is considered small. The F-square value of 0.000 for "Market Pressure" indicates an even smaller effect size, suggesting that "Market Pressure" has virtually no explanatory power in predicting "R.Certification." In summary, based on these results, neither "Attitudes towards Sustainability" nor "Market Pressure" appears to have a significant impact on "R.Certification." The effect sizes are extremely small, indicating that these variables contribute very little to the variability in readiness to implement certification. Therefore, other factors not considered in this analysis may have more substantial influences on "R.Certification."

Table 4: F-square result

Exogenous Variables	R.Certification
A.T.Sustainability	0.008
M.Pressure	0.000

Large:  $f^2$  effect size > 0.34; Medium effect > 0.14; Small:  $f^2$  > 0.01 (Cohen, 1988)

#### 4.3.3 Evaluation of Correlation Among Predictors

Multicollinearity is assessed using the Variance Inflation Factor (VIF), with values below five indicating no collinearity issues. In this study, the inner VIF values are all below 5 as stated in Table 5 suggesting no significant multicollinearity concerns (Pallant, 2007). The VIF value of 3.342 indicates the extent to which the variance of the estimated regression coefficient for "A.T.Sustainability" is inflated due to multicollinearity with other predictor variables. Since the VIF value is below 10, it suggests that there is moderate multicollinearity associated with "A.T.Sustainability," but it may not be severe enough to cause major concerns about the reliability of the regression coefficient estimates. Similarly, the VIF value of 3.033 for "Market Pressure" indicates moderate multicollinearity with the other predictor variables. Again, since the VIF value is below 10, it suggests that while there is some degree of multicollinearity associated with "Market Pressure," it may not substantially compromise the reliability of the regression coefficient estimates. Overall, these results indicate that there is moderate multicollinearity among the exogenous variables "Attitudes towards Sustainability" and "Market Pressure" in their relationship with the endogenous variable "R.Certification." While multicollinearity exists, it does not appear to be severe enough to invalidate the regression coefficient estimates.

Table 5: Result Of Multicollinearity – Inner VIF Values

Exogenous Variables	R.Certification
A.T.Sustainability	3.342
M.Pressure	3.033

#### 4.3.4 Predictive Performance Evaluation

Predictive relevance is evaluated using Geisser's  $Q^2$ , which assesses the model's ability to predict endogenous constructs. A positive  $Q^2$  value indicates a good fit and strong predictive significance (Geisser, 1975). Table 6 shows predictive relevance, provide insights into the performance of the model in predicting the endogenous variable, "R.Certification," which likely represents readiness to implement certification. The  $Q^2$  value of 0.370 indicates the extent to which the variance in the endogenous variable "R.Certification" is explained by the model after cross-validation. A value closer to 1 suggests that the model is successful in capturing and explaining the variation in "R.Certification" across different samples. In this case, the  $Q^2$  value of 0.370 indicates a moderate level of predictive relevance, suggesting that the model is reasonably effective in predicting readiness to implement certification.

The  $Q^2$  value of 0.225 represents the redundancy in the model after cross-validation. It indicates the proportion of variance in "R.Certification" that is redundant or not explained by the model. A lower  $Q^2$  value suggests that there may be unexplained variance or noise in the model, which could potentially be addressed by refining the model or adding more relevant variables. Here, the  $Q^2$  value of 0.225 suggests that there is some redundancy in the model, implying that there may be factors influencing readiness to implement certification that are not adequately captured by the current model.

In summary, these results indicate that while the model demonstrates moderate predictive relevance in explaining readiness to implement certification, there is still some unexplained variance or redundancy that may need further investigation or refinement in the model to improve its predictive accuracy.

Table 6: Result of Predictive Relevance

Endogenous Variable	CCR $Q^2 (=1-SSE/SSO)$	CCC $Q^2 (=1-SSE/SSO)$
R.Certification	0.225	0.370

CCC=Construct Cross-validated Commuality, CCR=Construct Cross-validated Redundancy

#### 4.4 Direct Influence Assessment

The evaluation of direct effects, represented by path coefficients, is fundamental in understanding the relationships between predictor and outcome variables within the structural model. In this study, Smart-PLS software was employed to calculate path coefficients, which are akin to the standardization in multiple regression analysis (Chin, 1998). Bootstrapping, a resampling technique, was utilized to generate t-statistics and confidence intervals, providing robust estimates without the distributional assumptions associated with traditional statistical tests (Chin, 1998).

Table 7 presents the results of the path coefficient assessment, focusing on the two hypotheses pertaining to the relationship between Attitudes towards Sustainability (A.T. Sustainability) and Sustainability Certification (R. Certification), and Market Pressure (M. Pressure) and Sustainability Certification (R. Certification). The p-

values associated with these hypotheses are reported to be 0.195, 0.348, and 0.948, respectively. Given that all p-values are greater than the conventional significance level of 0.05, the relationships are deemed statistically non-significant.

Additionally, the corresponding t-values for the hypotheses are provided in Table 7, with values of 1.298 and 0.065, respectively. These t-values fall below the critical threshold of 1.96, further confirming the lack of statistical significance in the relationships between A.T. Sustainability and R. Certification, and M. Pressure and R. Certification.

Figure 3 visually depicts the t-valued Structural Model derived from bootstrapping results, providing a graphical representation of the relationships between the predictor and outcome variables. The non-significant paths are illustrated, emphasizing the absence of significant direct effects between the predictor variables (Attitudes towards Sustainability and Market Pressure) and the outcome variable (Sustainability Certification). In summary, the direct effect analysis using path coefficients reveals that neither Attitudes towards Sustainability nor Market Pressure has a significant direct effect on Sustainability Certification in the studied context. These findings contribute to a nuanced understanding of the factors influencing smallholders' participation in sustainable certification within the Malaysian palm oil industry.

Table 7: Path coefficient result

Hypotheses	OS/Beta	LL	UL	T	P	Decision
H1: A.T.Sustainability -> R.Certification	0.106	-0.037	0.262	1.298	0.195	Not Significant
H2: M.Pressure -> R.Certification	-0.004	-0.115	0.107	0.065	0.948	Not Significant

Significant:  $p < 0.05$

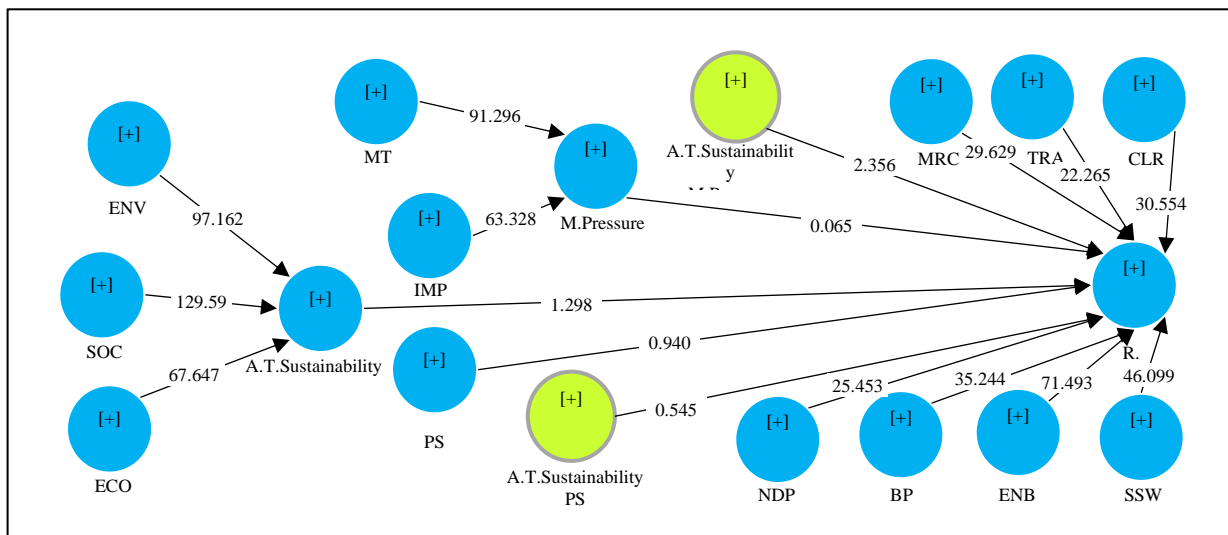


Figure 3: Structural Model with t-values (Bootstrapping result)

#### 4.5 Moderation Effect Analysis

Following the assessment of the core model's direct path linkages, the study proceeds to investigate the moderating influence of Market Pressure (M.Pressure). Utilizing bootstrapping, this analysis aims to discern the moderating effect within the structural model. Bootstrapping is recommended for observing moderating impacts, particularly when independent or moderator variables are continuous (Henseler & Fassott, 2010).

Table 8 presents the results of the moderation effect analysis, focusing on the hypothesis regarding the interaction between Attitudes towards Sustainability (A.T. Sustainability) and Market Pressure (M.Pressure) on Sustainability Certification (R. Certification).

The statistical significance of this hypothesis is assessed based on the t-values and p-values derived from the bootstrapping procedure. The t-values exceeding 1.96 and the associated p-values below 0.05 indicate a statistically significant moderation effect. Specifically, Market Pressure (M.Pressure) is found to significantly modify the relationship between Attitudes towards Sustainability (A.T. Sustainability) and Sustainability Certification (R. Certification).

This finding highlights the nuanced interplay between attitudes towards sustainability and external market pressures in influencing the adoption of sustainability certification within the Malaysian palm oil industry. Market pressures serve as a significant moderator, shaping how smallholders' attitudes towards sustainability translate into actions towards certification.

The moderation effect analysis enriches our understanding of the complex dynamics at play within the palm oil industry, highlighting the importance of external factors in shaping sustainable practices. It emphasizes the need for policymakers and industry stakeholders to consider market pressures as crucial determinants in promoting sustainable certification initiatives. As supported by study done by Ayompe et al. (2023) and

Apriani et al. (2020), that smallholders need market access to sell their products, and the global market only allows for palm oil products with sustainable certifications in the global value chain.

In summary, the moderation effect analysis reveals a significant interaction between Attitudes towards Sustainability, Market Pressure, and Sustainability Certification, shedding light on the moderating role of external market forces in driving sustainability practices within the industry.

Table 8: Moderation result

Hypotheses	OS/Beta	LL	UL	T	P	Decision
H3: A.T.Sustainability*M.Pressure -> R.Certification	-0.151	-0.269	-0.021	2.356	0.019	Significant

Significant; \*p < 0.05

#### 4.6 Summary of the hypotheses testing result

The hypotheses testing results are summarized in Table 9, providing a comprehensive overview of the acceptance or rejection of each hypothesis. Out of the three hypotheses examined in the study, only one was significant, while the other two were not significant based on the statistical analysis conducted.

H1: There is a direct effect between Attitudes Towards Sustainability (A.T.Sustainability) and Readiness To Implement Sustainability Certification (R.Certification) – Not Significant.

This hypothesis suggests a direct influence of attitudes towards sustainability on readiness to implement certification. However, the results indicate that there is not a statistically significant relationship between attitudes towards sustainability and readiness to implement certification. In other words, the data do not provide enough evidence to support the idea that attitudes towards sustainability alone significantly predicts readiness to implement certification.

H2: There is a direct effect between Market Pressure (M.Pressure) and Readiness to Implement Certification (R.Certification) – Not Significant.

This hypothesis proposes a direct influence of market pressure on readiness to implement certification. Similarly, the results indicate that there is not a statistically significant relationship between market pressure and readiness to implement certification. The data do not offer sufficient evidence to conclude that market pressure alone significantly predicts readiness to implement certification.

H3: There is an indirect moderating effect between Attitudes Towards Sustainability (A.T.Sustainability), Market Pressure (M.Pressure), and Readiness To Implement Sustainability Certification (R.Certification) – Significant.

This hypothesis examines the interaction effect between attitudes towards sustainability and market pressure on readiness to implement certification. In contrast to H1 and H2, the results suggest that there is a statistically significant relationship between the interaction of attitudes towards sustainability and market pressure and readiness to implement certification. This means that when considering both attitudes towards sustainability and market pressure together, their interaction significantly predicts readiness to implement certification.

In summary, while the direct effects of attitudes towards sustainability and market pressure on readiness to implement certification were not statistically significant individually, their interaction appears to have a significant influence on readiness to implement certification. This underscores the importance of considering the combined effects of multiple factors when analysing complex relationships in research.

Table 9: Summary of all hypotheses results

No.	Hypotheses	Results
H1	A.T.Sustainability -> R.Certification	Not Significant
H2	M.Pressure -> R.Certification	Not Significant
H3	A.T.Sustainability*M.Pressure -> R.Certification	Significant

## 5. CONCLUSION

In conclusion, the discussion emphasizes the urgency of prioritizing knowledge transfer and sustainable practices among independent smallholders in the palm oil industry. Addressing negative perceptions, transitioning towards sustainability, and mitigating the impacts of climate change are essential steps for safeguarding the industry's future. By embracing sustainability principles, the palm oil sector can foster environmental stewardship, enhance community livelihoods, and contribute to global food security in a rapidly changing world.

This research addresses significant gaps in academic literature and industrial practices regarding sustainability certification in the palm oil industry, particularly focusing on the participation of smallholders. While sustainability certification initiatives have been implemented, their effectiveness in ensuring smallholder participation has been questioned. This study sought to identify the factors influencing smallholders' decisions to engage in sustainability certification and shed light on the role of market pressure in this process.

The investigation uncovered critical insights into the determinants of smallholders' readiness to participate in sustainability certification. Notably, the study highlighted the significant influence of market pressure on



smallholders' decisions, particularly in driving them towards more sustainable practices. This influence was further moderated by their attitudes towards sustainability, underscoring the complex interplay of factors shaping certification adoption among smallholders.

### **Implications and Recommendations:**

The findings of this study carry important implications for policymakers and practitioners in the palm oil industry. By recognizing the pivotal role of market pressure in motivating smallholders to embrace sustainability certification, policymakers can design more targeted interventions and support mechanisms to facilitate certification uptake. Likewise, practitioners can leverage market dynamics to incentivize smallholders and promote sustainable practices effectively.

### **Limitations and Future Research Directions:**

While this study provides valuable insights, it is not without limitations. The scope of the research may be further expanded through a more in-depth examination of the feasibility of introducing sustainability certification in different contexts. Future research could explore the underlying contextual challenges and opportunities in diverse geographical areas, thereby enhancing the generalizability of the findings. Additionally, a comprehensive analysis of sustainability practices beyond certification could offer a more holistic understanding of smallholder engagement in sustainable agriculture.

In conclusion, this research contributes to the existing knowledge by shedding light on the factors influencing smallholders' participation in sustainability certification within the palm oil industry. By elucidating the role of market pressure and attitudes towards sustainability, the study offers valuable insights for advancing sustainable practices in the sector. Moving forward, a concerted effort from policymakers, practitioners, and researchers is essential to address the complexities of sustainability certification and promote responsible palm oil production practices.

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