Consumer Perspectives on the Sustainability of the Malaysian Palm Oil Supply Chain: Awareness, Price Sensitivity, and Certification Impacts

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Abstract

The purpose of this study is to investigate the sustainability of the Malaysian palm oil supply chain from the perspective of consumer behavior. Specifically, it aims to assess consumer awareness of the environmental and social implications of palm oil production, examine the impact of price sensitivity on purchasing decisions, and explore the influence of eco-friendly certifications like the RSPO on consumer preferences. The research employs a structured survey distributed both online and in-person to a diverse sample of Malaysian consumers. With a sample size of 200 respondents, the survey evaluates variables such as customer awareness, price sensitivity, and the influence of product labeling and certification on the demand for sustainable palm oil. The study finds that consumer awareness significantly impacts the demand for sustainable palm oil, with higher awareness correlating with a greater preference for sustainably sourced products. Price sensitivity remains a barrier, as many consumers are reluctant to pay premiums for eco-friendly options. Furthermore, clear and credible product labeling and certifications like RSPO positively influence consumer trust and demand for sustainable palm oil. Policymakers and industry stakeholders can leverage these insights to develop targeted strategies that promote sustainable palm oil practices. This study contributes to the existing literature by providing a comprehensive analysis of the factors influencing consumer demand for sustainable palm oil in Malaysia, a major global producer. It integrates theories such as the Theory of Planned Behavior, Price-Quality Inference Theory, and Signaling Theory to explain consumer behavior dynamics.

Keywords: sustainable palm oil, consumer behaviour, environmental awareness, price sensitivity, eco-friendly certification, Malaysia.

1.0 Introduction

Palm oil is a crucial commodity in the global agricultural market, extensively used in food products, cosmetics, and biofuels. Malaysia is one of the largest producers and exporters of palm oil, contributing significantly to the global supply (Basiron, 2007; Tan et al., 2009). The country's palm oil industry plays a vital role in its economy, providing employment and generating substantial revenue (MPOC, 2020). However, the industry has been under scrutiny due to environmental concerns, including deforestation, loss of biodiversity, and greenhouse gas emissions, as well as social issues such as labour rights violations (Meijaard et al., 2018; Pye, 2019; Vijay et al., 2016).

Understanding consumer perspectives on the sustainability of the Malaysian palm oil supply chain is essential for addressing these concerns and promoting sustainable practices. This study aims to explore Malaysian consumers' awareness of palm oil's environmental and social impacts, their price sensitivity regarding sustainably produced palm oil, and the influence of product labelling and certification on their purchasing decisions (Chew & Phau, 2019; Vermeir & Verbeke, 2008). By addressing these objectives, the study seeks to provide insights that can inform policymakers, industry stakeholders, and marketers in their efforts to promote sustainable palm oil practices, ultimately contributing to the broader goals of environmental conservation and social responsibility. The findings could help in developing strategies to enhance consumer awareness and demand for sustainable palm oil, ultimately supporting Malaysia's efforts to achieve a more sustainable and ethically responsible palm oil industry (Schouten & Glasbergen, 2011).

As such, this study bridges consumer behavior with sustainable practices in Malaysia’s palm oil industry. Insights into awareness, price sensitivity, and labeling can guide efforts toward environmentally and socially responsible practices. Promoting sustainable palm oil benefits both the economy and global sustainability goals by addressing key supply chain challenges.

2.0 Literature Review

2.1 Consumer Awareness

Consumer awareness plays a pivotal role in shaping demand for sustainable palm oil, with multiple studies highlighting its importance in driving more responsible consumption patterns. Research has shown that consumers are more likely to prefer sustainably sourced alternatives when they are informed about the environmental consequences of conventional palm oil production, such as deforestation, habitat destruction, and biodiversity loss (Joshi & Rahman, 2015). Beyond environmental concerns, social issues-such as labor rights violations and the exploitation of indigenous communities-also influence purchasing behavior. Consumers who prioritize ethical considerations, including environmental conservation and social justice, tend to favor products aligned with sustainable practices (Lee, 2009).

The literature suggests that a well-informed consumer base is essential for promoting sustainable consumption. Education and awareness initiatives have the potential to address knowledge gaps by highlighting the importance of sustainable palm oil and the detrimental impact of unsustainable practices (Schouten & Glasbergen, 2011). These efforts can generate greater demand for certified sustainable products and encourage industry stakeholders to adopt environmentally and socially responsible practices. Furthermore, as consumer awareness increases, businesses and policymakers face growing pressure to implement sustainable production methods, creating a positive feedback loop that strengthens sustainable supply chains (Abideen, Sundram, & Sorooshian (2023). Thus, enhancing consumer knowledge through targeted campaigns is critical for fostering long-term demand for sustainable palm oil and achieving broader sustainability goals.

2.2 Price Sensitivity

Price sensitivity is widely recognized as a critical factor influencing consumer behavior toward sustainable palm oil. While a niche segment of consumers is willing to pay a premium for sustainably sourced products, most consumers remain highly price-sensitive, prioritizing affordability over sustainability (Vermeir & Verbeke, 2008). This sensitivity to price presents a significant barrier to the widespread adoption of sustainable palm oil, as the higher production costs

associated with sustainable practices—such as eco-friendly farming methods, fair labor practices, and compliance with environmental standards—are often transferred to the end consumer (Brécard et al., 2009). As a result, sustainable palm oil products are typically priced higher than their conventional counterparts, making them less accessible to the average consumer.

The literature suggests that price sensitivity must be addressed through a combination of strategic interventions to enhance market acceptance (Joshi & Rahman, 2015). Government subsidies and financial incentives for producers can play a pivotal role in offsetting the additional costs associated with sustainable production, thereby making such products more affordable. Additionally, achieving economies of scale through increased production and demand can further reduce costs, helping to close the price gap between sustainable and non-sustainable products (Schouten & Glasbergen, 2011). Collaboration among industry stakeholders, policymakers, and NGOs is also essential to develop innovative solutions that lower production costs without compromising sustainability standards. Addressing price sensitivity through these measures is crucial for encouraging greater consumer adoption and driving the transition toward more sustainable palm oil consumption.

2.3 Product Labeling and Certification

The presence of eco-friendly certifications, such as the Roundtable on Sustainable Palm Oil (RSPO), plays a crucial role in shaping consumer preferences toward sustainable products. Certification acts as a trusted indicator of product credibility, signaling that the producer is committed to environmentally and socially responsible practices (Schouten & Glasbergen, 2011). By providing consumers with assurance about the sustainability of the product, certifications help build trust and encourage ethical consumption. When consumers encounter clear and recognizable labels, they are more likely to choose sustainable palm oil products over conventional ones, as labeling simplifies decision-making by reducing information asymmetry (Taufique et al., 2014).

However, the literature highlights that the effectiveness of certifications in influencing consumer behavior hinges on consumer awareness and understanding of what these certifications represent (Brécard et al., 2009). A lack of familiarity with certification schemes or confusion over the significance of different labels can undermine their

impact, resulting in lower demand for sustainable products. Therefore, educational initiatives that increase public understanding of eco-certifications are essential to maximize their effectiveness. By improving consumer awareness, these initiatives can enhance trust in certified products and promote more sustainable purchasing behaviors (Joshi & Rahman, 2015). Moreover, increased transparency in labeling practices can further empower consumers, fostering greater accountability among producers. Thus, product labeling and certification, supported by consumer education, play a critical role in driving demand for sustainable palm oil and advancing industry-wide sustainability goals (Abideen et al., 2023).

2.4 Consumer Demand for Sustainable Palm Oil

Consumer demand for sustainable palm oil is a multifaceted concept influenced by various factors, including environmental awareness, ethical considerations, and market dynamics. Understanding these influences is crucial for promoting sustainability within the palm oil industry. Social norms and peer behavior also affect consumer demand for sustainable palm oil. Consumers are more likely to purchase sustainable products if they perceive that such behavior is socially accepted and valued (Goldstein et al., 2008). Social influence can be leveraged through marketing strategies that highlight the popularity and societal benefits of sustainable palm oil, thereby encouraging more consumers to make ethical choices. As such, consumer demand for sustainable palm oil is influenced by a combination of environmental awareness, ethical considerations, economic factors, certification, labeling, and social norms (Brécard et al., 2009). Enhancing consumer education, making sustainable options more economically viable, and effectively communicating the value of certifications can collectively drive the demand for sustainable palm oil. Understanding these dynamics is crucial for stakeholders aiming to promote sustainability within the palm oil industry (Abideen et al., 2023).

2.5 Sustainable Supply Chain Practices

Sustainable supply chain practices play a vital role in promoting environmentally and socially responsible business operations, particularly in industries like palm oil production, which faces numerous sustainability challenges (Joshi & Rahman, 2015). These practices

encompass efforts to reduce environmental impact, improve resource efficiency, and ensure social equity throughout the supply chain. In Malaysia, sustainable practices involve the integration of eco- innovation, low-carbon initiatives, and effective waste management to minimize the environmental footprint (Atikah et al., 2024; Muhammad et al., 2023a). Key strategies include adopting sustainable farming methods, such as reducing deforestation and preserving biodiversity, alongside efforts to support smallholder farmers, who are critical to the supply chain but often face significant barriers to sustainability (Abideen et al., 2023). The use of certifications like the Roundtable on Sustainable Palm Oil (RSPO) further promotes transparency and traceability, enhancing consumer trust and aligning products with global sustainability standards (Muhammad et al., 2023b). To foster these efforts, stakeholders emphasize resilient supply chains by integrating resource-efficient technologies and mitigating disruptions, which supports long-term operational sustainability (Alqasa & Sundram, 2024). Additionally, partnerships among government bodies, industry stakeholders, and NGOs have been instrumental in promoting these sustainable practices by encouraging the adoption of green logistics, reverse logistics, and lean manufacturing approaches (Narayanan et al., 2024a; Narayanan et al., 2024b). Such collaborative frameworks not only improve the environmental performance of supply chains but also enhance their economic viability by reducing costs and increasing efficiency through strategic innovation and sustainability- oriented policies (Sivan et al., 2024; Sundram et al., 2023). These practices, supported by research and policy initiatives, highlight the importance of balancing economic, environmental, and social goals to achieve sustainable development in Malaysia's supply chains.

3.0 Research Methodology

3.1 Research Model and Hypotheses

In this study, the development of the theoretical framework is based on the anticipated relationships between determinants of customer awareness, price sensitivity, product labeling and certification toward customer demand for sustainable palm oil in Malaysia. The framework below, developed based on three hypotheses derived from the literature, depicts the relationship among the variables in the theoretical framework (Figure 1).

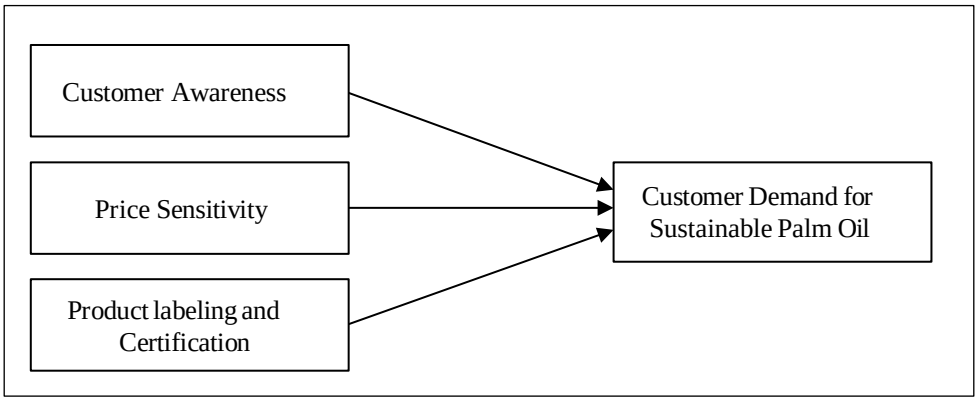

Figure 1 : Theoretical Framework

The theoretical framework integrates these variables to explain the factors driving consumer demand for sustainable palm oil. Customer awareness influences attitudes and perceived social norms, Price sensitivity affects economic decision-making, and Product labeling and certification serve as credible signals that reduce information asymmetry. By understanding these dynamics, stakeholders can design effective strategies to promote sustainable palm oil, aligning consumer behavior with environmental and social goals. Therefore, the following directional hypothesis is formulated are formulated with the support of underpinning theories.

Customer Awareness refers to the degree to which consumers are informed about the environmental and social implications of palm oil production. The underpinning theory for this variable is the Theory of Planned Behavior (TPB) proposed by Ajzen (1991). TPB posits that behavior is directly influenced by behavioral intentions, which are shaped by attitudes, subjective norms, and perceived behavioral control. In this context, increased awareness leads to a positive attitude towards sustainable palm oil, enhances the perceived social pressure (subjective norms) to choose sustainable products, and improves consumers' confidence in their ability to make informed decisions (perceived behavioral control). Consequently, higher awareness is expected to increase the demand for sustainable palm oil (Vermeir & Verbeke, 2008).

H1 Customer awareness is positively associated with consumer demand for sustainable palm oil

Price Sensitivity examines how fluctuations in price affect consumer purchasing decisions. This variable is underpinned by the Price-Quality Inference Theory (Monroe, 1973), which suggests that consumers often use price as an indicator of quality. However, in the case of sustainable products, the higher prices can act as a deterrent if consumers are highly price-sensitive. This relationship is further explained by the Economic Theory of Consumer Behavior, which posits that consumers aim to maximize utility given their budget constraints (Stigler, 1950). For consumers with high price sensitivity, the increased cost of sustainable palm oil may outweigh their preference for sustainability, thereby reducing demand (Brécard et al., 2009). The directional hypothesis is formulated as follows:

H2 Price sensitivity is positively associated with consumer demand for sustainable palm oil

Product Labeling and Certification involve the use of eco-labels and certifications such as the Roundtable on Sustainable Palm Oil (RSPO) to signify the sustainability of products. The Signaling Theory (Spence, 1973) underpins this variable. According to this theory, labels and certifications serve as signals that convey information about the product's attributes that are otherwise not easily observable. Eco-labels reduce information asymmetry and build trust among consumers, leading to increased demand for products that are certified as sustainable (Schouten & Glasbergen, 2011). Additionally, the Consumer Trust Theory posits that trust in certifications enhances consumers' perceptions of product credibility and integrity, thereby influencing their purchasing decisions (Taufique et al., 2014). The directional hypothesis is formulated as follows:

H3 Product labeling and certification is positively associated with consumer demand for sustainable palm oil

3.2 Population and Sampling Procedure

The study targets a diverse range of Malaysian consumers who purchase products containing palm oil, ensuring a comprehensive understanding of consumer behavior towards sustainable palm oil, particularly given Malaysia's significant role in the global industry. Employing a multi-stage sampling method, the process begins with stratified sampling based on key demographics such as age, gender,

income, and education levels, followed by random sampling within each stratum to minimize bias and ensure representativeness (Etikan & Bala, 2017).

Using Cochran's formula, the sample size will be approximately 384 respondents, with adjustments based on response rates (Cochran, 1977). Data collection will involve structured surveys both online and in-person, covering consumer awareness, price sensitivity, and the impact of product labeling and certification. Online surveys will reach a broad audience, while in-person surveys at retail outlets will ensure diverse participation.

To guarantee representativeness, quotas based on national demographics will be set, and efforts will be made to include consumers from various socioeconomic backgrounds. Ethical considerations, including voluntary participation, informed consent, and confidentiality, will be strictly adhered to (Creswell & Creswell, 2017). This robust sampling procedure is designed to capture diverse consumer perspectives, ensuring reliable and valuable insights for promoting sustainable palm oil consumption.

3.3 Questionnaire Development

Developing a robust questionnaire is a critical component of this research study, designed to assess consumer demand for sustainable palm oil in Malaysia. The questionnaire aims to gather comprehensive data on three independent variables: Customer Awareness, Price Sensitivity, and Product Labeling and Certification, and their influence on the dependent variable, Customer Demand for Sustainable Palm Oil. The questionnaire is structured into five sections to ensure clarity and coherence, facilitating an easy and logical flow for respondents. The sections include demographics, Customer Awareness, Price Sensitivity, and Product Labeling and Certification, and Customer Demand for Sustainable Palm Oil. Table 1 refers to the main construct and the corresponding items and references.

To ensure reliability and validity, several design considerations were applied to the questionnaire. A pilot study with a small sample of respondents was conducted to assess the clarity, relevance, and comprehensiveness of the questions, with feedback incorporated to refine both the content and structure (Presser et al., 2004). A Likert scale, ranging from "strongly disagree" to "strongly agree," was employed to measure attitudes and perceptions, as it effectively captures the intensity of respondents' opinions and provides nuanced

data (Likert, 1932). The questionnaire was also translated into Malay to enhance accessibility and comprehension for non-English-speaking respondents, with attention given to cultural nuances to ensure the questions were contextually appropriate and free from bias (Brislin, 1970). Ethical considerations included informing participants about the study's purpose, ensuring voluntary participation, maintaining the confidentiality of responses, and obtaining informed consent prior to participation (Creswell & Creswell, 2017).

3.4 Data Collection Procedures

The data collection process for this study involves a combination of structured surveys, both online and in-person, aimed at capturing comprehensive insights from a diverse range of Malaysian consumers who purchase products containing palm oil. The primary goal is to understand consumer behavior towards sustainable palm oil consumption in Malaysia, a country with a significant role in the global palm oil industry. The online surveys were distributed widely to capture diverse consumer perspectives efficiently from various geographic locations within Malaysia. This method allows for broad participation and inclusivity. In-person surveys, conducted at retail outlets, aim to reach consumers who might not be accessible through online methods, ensuring a more diverse demographic representation, including those with limited internet access. This dual approach ensures that the data collected are extensive and representative of the overall population.

Ethical considerations are paramount in this study, with a strong emphasis on voluntary participation and informed consent. Respondents were fully informed about the study's purpose, and their consent will be sought before participation, ensuring they are aware of and agree to the data collection process. Additionally, strict confidentiality measures will be implemented to protect respondents' information. The data was anonymized to protect the privacy of all participants, ensuring that their personal information remained confidential and was neither disclosed nor misused (Alqasa & Sundram, (2024). This ethical framework ensures that the research adheres to high standards of integrity and respect for participants' rights.

Table 1 : Measurement of Variables

Variable	Measurement	Sources
Customer Awareness	Understand the importance of the environmental impact of palm oil production Knowledgeable about the social issues related to the palm oil industry seek information about sustainable palm oil when making purchasing decisions Familiar with the concept of RSPO (Roundtable on Sustainable Palm Oil) Recognize positive consequences associated with sustainable palm oil production	Azizan & Suki (2020); Yusof & Sinaga (2018); Tan et al. (2019); Vermeir & Verbeke (2006)
Price Sensitivity	Price of palm oil products influences buying decisions Willing to pay a premium for sustainably sourced palm oil products Consider price fluctuations when choosing between different palm oil brands Affordability impacts my preference for palm oil alternatives Willing to pay more for palm oil products with eco-friendly certifications	De Pelsmacker et al. (2005); Grunert et al. (2014)
Product Labeling and Certification.	Eco-friendly certifications on palm oil product Sustainability labels when purchasing palm oil Palm oil products more if it has a clear certification Switch brands based on the presence or absence of sustainability labels Certified palm oil products are better for the environment."	Grunert et al. (2014); Taufique et al. (2014)
Customer Demand for Sustainable Palm Oil	Willing to pay a premium price for palm oil products that support environmental conservation Recommend sustainably sourced palm oil to others Seek out sustainably produced palm oil in stores	De Pelsmacker et al. (2005); Tan et al. (2019); Vermeir & Verbeke (2008)

Variable	Measurement	Sources
	Sustainability factor significantly influences my overall satisfaction Willing to pay a premium for palm oil products that support environmental conservation."	

3.5 Data analysis

3.5.1 Response Rate

Table 2 provides a detailed demographic breakdown of the respondents participating in the study, highlighting the diversity in gender, age, education level, monthly income, employment status, and geographic location. This ensures a comprehensive understanding of the various consumer segments' perspectives on sustainable palm oil. Firstly, the gender distribution, while balanced, could benefit from a more nuanced exploration of how gender influences sustainability attitudes and purchasing behaviors. Previous research suggests that women may be more environmentally conscious and ethical in their purchasing decisions than men (Fisher & Arnold, 1994). Hence, a deeper analysis could investigate whether this trend holds within the context of palm oil.

The age distribution shows a significant representation of younger consumers (70% aged 18-35). This focus on younger demographics is critical as they are often more attuned to sustainability issues and digital information sources. However, the underrepresentation of older age groups (only 30% aged 36 and above) might overlook valuable insights from a demographic that controls significant purchasing power and may have different sustainability priorities (Carrigan, Szmigin, & Wright, 2004). Educational attainment is well-distributed, with a notable 35% holding a Bachelor's degree. This indicates a relatively educated sample, which may already possess a higher awareness of sustainability issues. Future studies could enhance this by examining how different levels of education specifically influence knowledge and attitudes about sustainable palm oil, potentially revealing gaps that targeted educational campaigns could address (Laroche, Bergeron, & Barbaro- Forleo, 2001).

Table 2 : Profile of Respondents

Demographic Variables	Categories	Frequency	Percentage (%)
Gender	Male	120	60
	Female	80	40
Age Group	18-25	50	25
	26-35	90	45
	36-45	40	20
	46 and above	20	10
Education Level	Secondary School	30	15
	Diploma/Technical Certificate	50	25
	Bachelor's Degree	70	35
	Master's degree and above	50	25
Monthly Income	Less than RM 2000	40	20
	RM 2000 – RM 4999	60	30
	RM 5000 – RM 7999	70	35
	RM 8000 and above	30	15
Employment Status	Employed	150	75
	Unemployed	20	10
	Student	20	10
	Retired	10	5
Geographic Location	Urban	140	70
	Suburban	40	20
	Rural	20	10

Income distribution shows a concentration in the RM 5,000- 7,999 range (35%). This middle-income bracket is pivotal for understanding price sensitivity, yet the study might further analyze how income disparities affect willingness to pay for sustainably sourced products. Higher-income groups may exhibit different purchasing behaviors and ethical considerations compared to lower-income groups (Gupta & Ogden, 2009). Employment status and geographic location provide additional layers for analysis. With 75% of respondents employed, the study reflects perspectives from a financially stable demographic. Including a more substantial proportion of unemployed or part-time workers could reveal how economic instability influences sustainability preferences. Additionally, the urban-centric sample (70% urban) might bias findings toward those with better access to sustainably labeled products. A more balanced geographic

representation could uncover regional disparities in awareness and access to sustainable options (Wynne & Williams, 1985).

In summary, while Table 2 offers a comprehensive demographic snapshot, critical and creative analysis suggests avenues for deeper exploration. Future research could benefit from a more balanced age distribution, a detailed examination of gender and education influences, an analysis of income-based purchasing behaviors, and a more geographically diverse sample. These adjustments would provide a richer, more nuanced understanding of consumer demand for sustainable palm oil in Malaysia.

3.5.2 Exploratory Factor Analysis on the Determinant Variables Table 3 presents the results of an exploratory factor analysis (EFA) conducted to identify the underlying factors influencing consumer awareness, price sensitivity, and product labeling and certification related to sustainable palm oil. The analysis aims to group related items into factors that represent distinct constructs. The result showed items after deleting the items that show either low factor loading (< 0.40) or high cross-loading (> 0.35). The results indicate that the loadings of the remaining items were from 0.40 to 0.85. These loadings are acceptable because they exceeded the minimum requirement level of 0.30 (Pallant, 2020; Hair et al., 2010).

The factor loadings for Customer Awareness items range from 0.62 to 0.68. These items measure consumers' understanding of the environmental and social impacts of palm oil production, their knowledge of the RSPO, and their proactive information-seeking behavior regarding sustainable palm oil. The loadings indicate a strong, coherent factor, suggesting that these items effectively capture the concept of customer awareness about sustainable palm oil.

Price Sensitivity items exhibit factor loadings between 0.46 and 0.85. The highest loading (0.85) is for the item stating that the price of palm oil products significantly influences buying decisions. Other items, such as willingness to pay a premium for sustainably sourced palm oil and considering price fluctuations when choosing brands, also load well onto this factor. This indicates that consumers' price sensitivity significantly influences their purchasing decisions regarding sustainable palm oil, though the lower loadings for some items suggest varying degrees of influence.

The items under Product Labeling and Certification load onto their factor with values ranging from 0.48 to 0.84. The highest loading

(0.84) is for the belief that certified palm oil products are better for the environment, followed by the importance of eco-friendly certifications (0.77). These high loadings indicate a strong consumer response to labeling and certification, reflecting their trust and preference for certified products. The lower loading for switching brands based on label presence (0.48) suggests that while certifications are valued, they may not always lead to brand loyalty shifts.

The eigenvalues for the three factors are 5.36, 2.17, and 1.93, respectively, explaining 14.02%, 11.52%, and 11.2% of the variance. The cumulative variance explained by these factors is 36.74%, which is relatively modest, indicating that other unexplored factors might also play a significant role in shaping consumer behavior towards sustainable palm oil. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy is 0.62, suggesting a middling adequacy for the factor analysis, while Bartlett's test of sphericity (not shown but typically considered) would indicate the suitability of the data for structure detection.

Table 3 : Summary of Factor Analysis on the Determinant Factors

Items	**Factors loadings**		
	1	**2**	**3**
Customer Awareness			
"I understand the importance of comprehending the environmental impact of palm oil production."	0.68		
"I am knowledgeable about the social issues related to the palm oil industry."	0.66		
"I actively seek information about sustainable palm oil when making purchasing decisions."	0.66		
"I am familiar with the concept of RSPO (Roundtable on Sustainable Palm Oil)."	0.64		
"I recognize positive consequences associated with sustainable palm oil production."	0.62		
Price Sensitivity			
"The price of palm oil products significantly influences my buying decisions."		0.85	
"I am willing to pay a premium for sustainably sourced palm oil products."		0.74	
"I consider price fluctuations when choosing between different palm oil brands."		0.51	
"Affordability impacts my preference for palm oil alternatives."		0.46	

Items	Factors loadings		
	1	2	3
"I am willing to pay more for palm oil products with eco-friendly certifications."		0.47	
Product labeling and Certification			
"Seeing eco-friendly certifications (e.g., RSPO, organic) on palm oil product labels is important to me."			0.77
"I actively look for sustainability labels when purchasing palm oil."			0.74
"I trust a palm oil product more if it has a clear certification."			0.73
"I would switch brands based on the presence or absence of sustainability labels."			0.48
"I believe that certified palm oil products are better for the environment."			0.84
Eigenvalue	5.36	2.17	1.93
Percentage of variance	14.02	11.52	11.2
KMO	0.62		

Notes: Items with factor loading < 0.40 were deleted; items with cross-loading between the factors > 0.35 were deleted.

3.5.3 Exploratory Factor Analysis on Customer Demand for Sustainable Palm Oil

Table 4 summarizes the results of the factor analysis for the items related to Customer Demand for Sustainable Palm Oil. The analysis revealed that all five items loaded significantly on a single factor, with factor loadings ranging from 0.64 to 0.71. The eigenvalue for this factor is 3.67, and it accounts for 30.57% of the variance in the data, indicating that this factor is a strong representation of the underlying construct. The KMO measure of sampling adequacy is 0.63, and Bartlett's test of sphericity is significant, supporting the appropriateness of using factor analysis for these items. The high factor loadings and the eigenvalue suggest that the items are well-grouped and effectively capture the concept of customer demand for sustainable palm oil.

Table 4 : Summary of Factors for Customer Demand for Sustainable Palm Oil

Items	Factors loadings
"I am willing to pay a premium price for palm oil products that support environmental conservation."	0.68
"I recommend sustainably sourced palm oil to others."	0.65
"I actively seek out sustainably produced palm oil in stores."	0.69
"The sustainability factor significantly influences my overall satisfaction with palm oil purchases."	0.64
"I am willing to pay a premium for palm oil products that support environmental conservation."	0.71
Eigenvalue	3.67
Percentage of variance	30.57
KMO	0.63

Note: One component was extracted. The solution cannot be rotated.

The factor analysis for Customer Demand for Sustainable Palm Oil shows that the items strongly converge on a single factor, providing a clear and concise measurement of this variable. The significant KMO value and Bartlett's test further validate the factor structure. Nonetheless, the total variance explained by this factor is 30.57%, which is relatively modest. This suggests that there may be other underlying factors influencing customer demand that were not captured in this study. Future research could explore additional dimensions or use a larger set of items to capture a more comprehensive picture of customer demand for sustainable palm oil.

3.5.4 Reliability Analysis

Reliability analysis is used to assess the consistency of a set of items in a survey or questionnaire (Tavakol & Dennick, 2011). One of the most common methods for evaluating reliability is through Cronbach's alpha, a measure of internal consistency. Cronbach's alpha values range from 0 to 1, with higher values indicating greater reliability. A commonly accepted rule of thumb is that an alpha of 0.7 or higher is considered acceptable in social science research (Nunnally & Bernstein, 1994).

Table 5 : Reliability Analysis: Cronbach's Alpha (*n* = 119) Actual Study Results

Variables	Number of Items	Item Deleted	Cronbach's Alpha
Customer Awareness	5	-	0.813
Price Sensitivity	5	-	0.951
Product Labeling and Certification.	5	-	0.873
Customer Demand for Sustainable Palm Oil	5	-	0.834

In Table 5, the reliability analysis for four variables—Customer Awareness, Price Sensitivity, Product Labeling and Certification, and Customer Demand for Sustainable Palm Oil—is presented. Each variable consists of five items, and none of the items were deleted in the analysis. These values indicate high reliability for each of the scales used to measure these constructs. Specifically, the alpha values for Customer Awareness, Product Labeling and Certification, and Customer Demand for Sustainable Palm Oil are all above 0.8, suggesting that the items within each scale are highly consistent. The alpha value for Price Sensitivity is exceptionally high at 0.951, indicating very strong internal consistency among the items measuring this variable.

3.5.5 Correlation Analysis

In Table 6, the correlation matrix shows the relationships between Customer Awareness, Price Sensitivity, Product Labeling and Certification, and Customer Demand for Sustainable Palm Oil. The significance of the correlations is indicated at the 0.01 level (2-tailed), meaning there is a 99% confidence that these correlations are not due to random chance (Dancey & Reidy 2011; Field, 2013; Pallant, 2020).

Table 6 : Correlation Analysis (*r*)

Variables	Customer Awareness	Price Sensitivity	Product Labeling and Certification	Customer Demand for Sustainable Palm Oil
Customer Awareness	*1.000*			
Price Sensitivity	- 0.7280**	*1.000*		
Product Labeling and Certification.	0.756**	- 0.856**	*1.000*	

Variables	Customer Awareness	Price Sensitivity	Product Labeling and Certification	Customer Demand for Sustainable Palm Oil
Customer Demand for Sustainable Palm Oil	0.773**	- 0.815**	0.893**	*1.000*

Note: ** Correlation is significant at the 0.01 level (2-tailed)

These results show strong positive correlations between all pairs of variables. For example, the correlation between Product Labeling and Certification and Customer Demand for Sustainable Palm Oil is very high (r = 0.893), indicating that as consumers recognize and value eco-friendly certifications on palm oil products, their demand for such sustainable products increases. Similarly, the strong correlation between Price Sensitivity and Product Labeling and Certification (r = - 0.856) suggests that consumers who are sensitive to prices also pay significant attention to product labeling and certifications when making purchasing decisions.

3.5.6 Multiple Regression Analysis

Table 7 presents the summary of the regression analysis for the study, which investigates the impact of various independent variables on the dependent variable, customer demand for sustainable palm oil.

Table 7 : Summary of the Regression Analysis

Independents variables	Dependent variable (Customer Demand for Sustainable Palm Oil) Standard β coefficients and significance level
Customer Awareness	0.320***
Price Sensitivity	- 0.286***
Product Labeling and Certification.	0.211***
R	0.802
R^2	0.688
Adjusted R^2	0.663
F	87.062***

Note: Significance levels: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Customer awareness is strong and significantly positively influencing customer demand for sustainable palm oil. This indicates

that consumers who are more informed about the environmental and social impacts of palm oil production are more likely to demand sustainably sourced palm oil products. The standardized coefficient (β = 0.320) suggests that for every unit increase in customer awareness, the customer demand for sustainable palm oil increases by 0.320 units, holding all other factors constant. The high β value (0.286) indicates that customer awareness is a critical factor in influencing customer demand, with a stronger impact compared to price sensitivity and product labeling and certification. Price sensitivity has a significant positive effect on the demand for sustainable palm oil. This implies that consumers who are not sensitive to price changes are more likely to demand sustainable palm oil products. Product labeling and certification also have a statistically significant impact on customer demand for sustainable palm oil in this study. Since there is a positive relationship, the statistical significance suggests that the current certification and labeling strategies are sufficiently effective in influencing consumer behavior.

Model $R^2 = 0.68.8$, indicates that approximately 68.8% of the variance in customer demand for sustainable palm oil can be explained by the three independent variables (customer awareness, price sensitivity, and product labeling and certification).: The F-statistic is highly significant ($F = 87.062$, $p < 0.01$), indicating that the regression model is a good fit for the data and that the independent variables collectively have a significant impact on the dependent variable. The regression analysis highlights the importance of customer awareness and price sensitivity in driving the demand for sustainable palm oil. While product labeling and certification are positively related to demand, their impact is not statistically significant in this study. The overall model explains a substantial portion of the variance in consumer demand, suggesting that enhancing customer awareness and addressing price sensitivity are critical strategies for increasing the demand for sustainable palm oil in Malaysia.

4.0 Discussion

This study investigated the factors influencing consumer demand for sustainable palm oil in Malaysia, focusing on customer awareness, price sensitivity, and product labeling and certification. The regression analysis revealed that customer awareness, price sensitivity and product labeling and certification significantly impact consumer

demand. This section discusses these findings in detail and their implications.

4.1 Customer Awareness

The analysis demonstrates that customer awareness is a significant predictor of the demand for sustainable palm oil. This finding aligns with previous research, which suggests that informed consumers are more likely to engage in environmentally friendly behaviors (Joshi & Rahman, 2015). When consumers are knowledgeable about the environmental and social impacts of palm oil production, they are more inclined to seek out and purchase sustainable alternatives.

This result underscores the importance of education and awareness campaigns in promoting sustainable palm oil consumption. Organizations and policymakers should invest in comprehensive educational initiatives that highlight the benefits of sustainable palm oil and the adverse consequences of unsustainable practices. Such campaigns could leverage various media platforms to reach a broad audience and effectively communicate the importance of choosing sustainably sourced products.

Moreover, the positive relationship between customer awareness and demand suggests that efforts to enhance transparency in the palm oil supply chain could further boost consumer demand. Providing detailed information about the sourcing and production practices of palm oil products can help consumers make informed decisions, thereby increasing the demand for sustainable options.

4.2 Price Sensitivity

Price sensitivity emerged as the most influential factor in the study, with a high positive impact on consumer demand for sustainable palm oil. This finding indicates that economic considerations are paramount in consumer purchasing decisions. Consumers who are more sensitive to price changes are significantly influenced by the cost of sustainable products.

This result has important implications for both producers and policymakers. To increase the market share of sustainable palm oil, it is crucial to address the price differential between sustainable and conventional products. Producers should explore cost-reduction strategies through economies of scale, improved efficiencies, and

technological innovations. Additionally, governments can play a pivotal role by providing subsidies, tax incentives, or other financial support to lower the price of sustainable palm oil products.

The significant influence of price sensitivity also suggests that consumers may perceive sustainable palm oil as a premium product. Marketing strategies that emphasize the added value and long-term benefits of sustainable products can help justify the higher cost and encourage consumers to pay a premium for sustainability.

4.3 Product Labeling and Certificate

In line with the positive correlation observed in the correlation analysis, product labeling and certification also did significantly impact consumer demand in the regression analysis. This result indicates that, since consumers may recognize and value eco-friendly labels, these labels are also strong enough to determinants of purchasing behavior when considered alongside customer awareness and price sensitivity. This finding suggests several potential issues with current labeling practices. First, there may be a lack of consumer trust in existing certification schemes. To address this, certification bodies and industry stakeholders need to enhance the credibility and transparency of their labeling processes. Second, consumers may not fully understand the meaning and importance of certification labels. Educational initiatives that explain the significance of these labels and their impact on sustainability could improve their effectiveness.

Furthermore, the finding implies that certification labels should be part of a broader strategy that includes raising awareness and making sustainable products more economically attractive. Simply labeling products as sustainable may not be sufficient; it should be accompanied by efforts to educate consumers and ensure that sustainable options are competitively priced.

5.0 Implications

5.1 Theoretical Implications

The findings of this study contribute significantly to the existing body of knowledge on sustainable consumption behavior. By demonstrating the strong relationships between consumer awareness, price sensitivity, and product labeling with the demand for sustainable palm oil, this research supports and extends several theoretical frameworks, including the Theory of Planned Behavior (Ajzen, 1991)

and the Value-Belief-Norm Theory (Stern, 2000). These theories suggest that consumer behavior is influenced by awareness, attitudes, and perceived behavioral control, which is supported by the positive correlations found in this study. Additionally, the study highlights the critical role of external factors such as economic incentives and labeling, providing empirical evidence that enhances the understanding of how external cues can shape sustainable consumer behavior.

5.2 Managerial Implications

For managers in the palm oil industry, these findings underscore the importance of strategic marketing and communication efforts. Managers should prioritize increasing consumer awareness about the benefits of sustainable palm oil through targeted campaigns that educate consumers about environmental and social impacts. Developing and promoting clear, credible certification labels like the RSPO can build consumer trust and drive preference for sustainable products. Additionally, managers should consider pricing strategies that make sustainable options more attractive, possibly through partnerships that offer discounts or incentives. Emphasizing sustainability in branding and marketing can enhance customer loyalty and differentiate products in a competitive market.

5.3 Policy Implications

Policymakers have a critical role in promoting sustainable palm oil consumption. The strong correlation between price sensitivity and demand indicates that economic policies can significantly influence consumer behavior. Governments could implement subsidies or tax incentives for sustainably produced palm oil to make it more affordable. Additionally, mandatory labeling regulations that require clear and accurate information about the sustainability of palm oil products can empower consumers to make informed choices. Policies that support public awareness campaigns and educational programs about the importance of sustainable palm oil can also drive consumer behavior towards more environmentally friendly options. Collaborating with industry stakeholders to ensure the credibility and enforcement of certification schemes will further enhance the effectiveness of these policies.

6.0 Conclusion, Limitation, and Future Research

This study highlights the critical role of consumer awareness, price sensitivity, and product labeling in driving the demand for sustainable palm oil in Malaysia. The strong correlations found in the analysis suggest that targeted strategies in these areas can significantly influence consumer behavior towards more sustainable choices. Educational initiatives, economic incentives, and robust certification schemes are key components in promoting sustainable palm oil consumption.

Despite the valuable insights, this study has several limitations. The research is based on self-reported data from consumers, which may be subject to biases such as social desirability bias. Additionally, the study focuses on Malaysian consumers, and the findings may not be generalizable to other contexts with different cultural, economic, and social dynamics. The cross-sectional nature of the study also limits the ability to infer causality between the variables.

Future research should address these limitations by employing longitudinal designs to establish causal relationships and exploring the impact of interventions over time. Expanding the study to include diverse geographical contexts can provide a more comprehensive understanding of global consumer behavior towards sustainable palm oil. Additionally, examining the role of digital media and online platforms in shaping consumer awareness and attitudes could offer new avenues for promoting sustainable consumption. Finally, integrating qualitative approaches could provide deeper insights into the underlying motivations and barriers consumers face in choosing sustainable palm oil.

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Consumer Perspectives on the Sustainability of the Malaysian Palm Oil Supply Chain: Awareness, Price Sensitivity, and Certification Impacts

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Abstract

The purpose of this study is to investigate the sustainability of the Malaysian palm oil supply chain from the perspective of consumer behavior. Specifically, it aims to assess consumer awareness of the environmental and social implications of palm oil production, examine the impact of price sensitivity on purchasing decisions, and explore the influence of eco-friendly certifications like the RSPO on consumer preferences. The research employs a structured survey distributed both online and in-person to a diverse sample of Malaysian consumers. With a sample size of 200 respondents, the survey evaluates variables such as customer awareness, price sensitivity, and the influence of product labeling and certification on the demand for sustainable palm oil. The study finds that consumer awareness significantly impacts the demand for sustainable palm oil, with higher awareness correlating

with a greater preference for sustainably sourced products. Price sensitivity remains a barrier, as many consumers are reluctant to pay premiums for eco-friendly options. Furthermore, clear and credible product labeling and certifications like RSPO positively influence consumer trust and demand for sustainable palm oil. Policymakers and industry stakeholders can leverage these insights to develop targeted strategies that promote sustainable palm oil practices. This study contributes to the existing literature by providing a comprehensive analysis of the factors influencing consumer demand for sustainable palm oil in Malaysia, a major global producer. It integrates theories such as the Theory of Planned Behavior, Price-Quality Inference Theory, and Signaling Theory to explain consumer behavior dynamics.

Author keywords

consumer behaviour; eco-friendly certification; environmental awareness; Malaysia; price sensitivity; sustainable palm oil

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