Driving Transformation in the Malaysian Palm Oil Industry and Supply Chain: A SWOT-Based Strategic Plan for Collaboration and Sustainability

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ABSTRACT

In recent times, the palm oil industry has faced a growing number of obstacles, encompassing negative public perception, environmental apprehensions, and stringent regulatory measures. The industry's sustainability has been jeopardised due to a combination of factors, including trade barriers, limited collaboration, and hindered market access. In order to effectively tackle these urgent concerns, the present study proposes a compelling strategic blueprint. The SWOT analysis of the Malaysian palm oil supply chain was conducted using qualitative analysis techniques to identify its strengths, weaknesses, opportunities, and threats. Afterwards, a comprehensive analysis of various strategies was conducted using the SWOT-Quantitative Strategic Planning Matrix (QSPM). The results revealed that the industry possesses advantageous conditions and a well-functioning supply chain, which can be considered a notable strength. However, it also faces significant weaknesses in terms of its environmental impact and sustainability challenges. The research conducted identified the promotion of certified sustainable palm oil as the most significant opportunity to address the increasing global demands. Additionally, the study highlighted those stricter regulations, which restrict market access, pose the primary threat to the palm oil industry. Furthermore, a comprehensive assessment of both internal and external factors has underscored the significance of diversity and competitive strategies. The QSPM identified the prioritisation of activating pre-existing infrastructure as the primary focus. This study makes a valuable contribution to the academic field by offering a comprehensive analysis and proposing a plan for enhancing the palm oil supply chain in light of adverse perceptions, advocacy efforts, and trade restrictions. Through strategic navigation of these challenges, businesses have the ability to unlock the full potential of the industry and establish a foundation for long-term and sustainable success.

KEYWORDS: Sustainability, Palm Oil Supply chain, SWOT-QSPM technique, IFE and EFE Matrix.

INTRODUCTION

In the contemporary and highly competitive business landscape, it is imperative for organisations to consistently assess and improve their supply chain management strategies in order to attain a competitive advantage (Sundram, Bahrin, & Govindaraju, 2016). The objective of this study is to examine the supply chain transformation of a company operating within the Palm Oil industry, employing the Supply Chain SWOT Analysis framework. Through the implementation of a thorough assessment, encompassing an examination of the existing supply

chain framework and its inherent advantages, disadvantages, potential avenues for growth, and potential risks, this particular case study aims to offer valuable insights pertaining to the organization's strategic approach to supply chain management (MPOC, 2023). First of all, the utilisation of the Supply Chain SWOT Analysis will be implemented as a strategic instrument to evaluate the internal and external factors impacting the performance of the company's supply chain. Through the process of identifying the strengths, weaknesses, opportunities, and threats, the analysis will provide valuable insights into crucial elements of the Palm Oil supply chain. Through a comprehensive examination of the supply chain within the industry, this study aims to develop specific recommendations and solutions that are customised to address the distinct requirements and market dynamics of the Palm Oil supply chain. To explain the Supply Chain SWOT Analysis, specific examples are furnished for each of the identified SWOT elements. This study aims to provide a comprehensive analysis of the impact of internal and external factors on the Palm Oil supply chain, thereby enhancing our practical understanding of this complex system. In addition, a quantitative evaluation will be undertaken to offer a data-centric analysis of the existing supply chain performance. Through a comprehensive analysis of each individual component, a comprehensive understanding of the supply chain system can be obtained, enabling the identification of specific areas that necessitate enhancement or optimization. Furthermore, a study will be conducted to identify the primary strengths and weaknesses of the existing supply chain system. This analysis aims to identify the strengths and weaknesses of the Palm Oil supply chain, focusing on areas of excellence as well as challenges and bottlenecks that may arise within the supply chain. In conclusion, an evaluation will be conducted on the technological capacities and digital framework that underpin the supply chain. This assessment aims to identify potential avenues for utilising technology, such as advanced analytics, automation, or blockchain, in order to improve supply chain visibility, collaboration, and efficiency.

UNDERSTANDING OF PALM OIL SUPPLY CHAIN

Mareeh et al. (2022) assert that supply chain transformation within the palm oil industry encompasses the implementation of novel technologies and methodologies to optimise the various stages of production and distribution. This includes the reduction of inefficiencies, waste, and resource depletion, as well as the enhancement of transparency, traceability, and overall sustainability. The authors place significant emphasis on the imperative of achieving a harmonious equilibrium between economic and environmental sustainability in order to attain enduring profitability and competitiveness. The authors propose a system dynamic modelling approach as a means to analyse the intricate interactions among various stakeholders within the supply chain of Malaysian crude palm oil. The objective is to identify potential areas for enhancement. This study emphasises the potential advantages of supply chain transformation, such as heightened operational effectiveness, decreased expenditures, enhanced product standards, and improved environmental and social outcomes. However, the authors point out the importance of meticulous planning, collaboration, and monitoring in order to address potential risks and guarantee fair distribution of benefits among all parties involved in the supply chain transformation process. Lai, Feng, and Zhu (2023) argue that the implementation of supply chain transformation (SCT) enables companies to effectively streamline their production processes, minimise inefficiencies, and augment the levels of transparency and traceability within their supply chains. Therefore, this strategic undertaking yields favourable outcomes such as sustainability, cost reduction, and enhanced competitiveness for these organisations. Digital transformation has become a significant facilitator of supply chain transformation (SCT), as technologies like artificial intelligence, the Internet of Things, and blockchain present novel prospects for companies to enhance their supply chain performance (Sundram et al., 2016).

Mareeh et al. (2022) and Nikoloyuk, Burns, and De Man (2010) provide an instance of supply chain transformation within the palm oil sector, wherein a system dynamics modelling approach is employed to enhance the sustainability and profitability of Malaysia's crude palm oil supply chain management. The aforementioned approach was subjected to analysis and subsequently put forth as a proposal. The objective of this study was to assess the effects of implementing supply chain transformation on the sustainability and profitability of the crude palm oil industry in Malaysia. The researchers employed a system dynamics methodology to model the intricate dynamics of the supply chain and ascertain the primary factors that influence both sustainability and profitability. The analysis encompassed various factors, such as climate change, land utilisation, labour efficiency, and governmental regulations, among other variables. The findings of the research indicated that the implementation of supply chain transformation has the potential to yield substantial enhancements in both sustainability and profitability. Mareeh et al. (2022) discovered that the implementation of waste reduction strategies, traceability enhancements, and stakeholder collaboration can yield positive outcomes such as heightened productivity, cost reduction, and enhanced environmental and social performance. However, the authors also observed that the achievement of supply chain transformation hinged upon meticulous strategic preparation, effective cooperation, and diligent oversight to mitigate potential hazards and guarantee fair allocation of advantages among all involved parties (Abideen, Sundram, & Sorooshian, 2023).

CURRENT PALM OIL INDUSTRY AND SUPPLY CHAIN ASSESSMENT

Through a comprehensive analysis of the external factors within the supply chain, a total of five significant opportunities and five primary threats have been discerned. Furthermore, following a comprehensive evaluation of every element of the supply chain internal analysis, a set of five strengths and five weaknesses that hold significant importance as internal factors have been identified. The primary opportunities, threats, strengths, and weaknesses of the supply chain, along with supplementary explanations, are presented in Appendix A. Table 2 presents the internal and external sub-criteria that exert an influence on the supply chain. Based on an extensive analysis and comprehensive examination of various factors, several strategies are put forth. The subsequent recommendations are derived from the findings obtained in this study.

A SWOT ANALYSIS OF THE PALM OIL SUPPLY CHAIN IN MALAYSIA:

Table 2. The internal and external sub-criteria affecting the Supply Chain

Internal factors affecting the Supply Chain Strengths (S)		Weaknesses (W)	
S1	Favourable conditions and efficient supply chain make it a top palm oil producer.	W1	Industry's environmental impact sparks criticism, sustainability challenges, and stricter regulations.
S2	Government fosters palm oil industry growth through policies, incentives, and regulations.	W2	Depends on international markets, making it susceptible to external factors.
S3	Expanded palm oil offerings, reduced reliance on single product through diversification.	W3	Palm oil industry's labour practices, like unfair wages and poor conditions, face scrutiny, risking reputation.
S4	Solid infrastructure enables efficient palm oil transportation and distribution locally and globally.	W4	Prices fluctuate due to weather, demand-supply dynamics, and policy changes, affecting profitability.
S5	Palm oil industry thrives through robust research, development, and innovation for global competitiveness.	W5	Raw palm oil exports hinder value addition and profit growth; investments in processing can enhance higher-value products and reduce reliance on commodity prices.

External factors affecting the Supply Chain Opportunities (O)		Threats (T)	
O1	Promote certified sustainable palm oil to meet global sustainability demands.	T1	Stricter rules limit palm oil access, challenging Malaysian producers.
O2	Global palm oil demand rises due to urbanization, population growth, and incomes. Malaysia can seize export opportunities.	T2	Other oils compete, market shifts affect palm oil demand.
O3	Expanded R&D explores palm oil's potential in biofuels, cosmetics, pharmaceuticals, diversifying revenue.	T3	Trade barriers hinder palm oil industry's market access, profitability.
O4	Leveraging technology enhances palm oil supply chain: automation, data analytics, precision farming.	T4	Negative perception and campaigns reduce palm oil market demand.
O5	Public, industry, NGOs collaborating can promote sustainability, tackle labour, enhance reputation.	T5	Climate change disrupts palm oil production, increasing costs and risks.

INTERNAL FACTOR EVALUATION [IFE] MATRIX

PALM OIL SUPPLY CHAIN IN MALAYSIA

The Internal Factor Evaluation (IFE) matrix is a strategic management instrument employed to evaluate the internal strengths and weaknesses of a company or organisation. In the present scenario, the application of this methodology is being employed to assess the palm oil supply chain in Malaysia. The IFE matrix is a framework that evaluates critical internal factors that impact the industry's overall performance and competitive position.

KEY INTERNAL FACTORS - *INTERNAL STRENGTHS*	SIGNIFICANT FACTOR	RANK	WEIGHTED SCORE
1. Abundant and Efficient Production	0.2	3	0.60
2. Government Support and Policies	0.1	3	0.30
3. Diversified Product Range	0.1	4	0.40
4. Established Infrastructure	0.1	3	0.30
5. Strong Research and Development	0.1	4	0.40
KEY INTERNAL FACTORS - *INTERNAL WEAKNESSES*			
1. Environmental Concerns	0.1	2	0.20
2. Dependency on Export Markets	0.05	2	0.10
3. Labour Issues	0.05	1	0.050
4. Price Volatility	0.1	2	0.20
5. Limited Value Addition	0.1	1	0.10
TOTAL	**1.00**		**2.65**

IFE Rating Factors: 1 = Major weaknesses; 2 = Minor weaknesses; 3 = Minor strength; 4 = Major strength

The IFE matrix for the palm oil supply chain in Malaysia has identified several strengths and weaknesses. These are as follows:

Internal Strengths:

1. Abundant and Efficient Production: Malaysia possesses a significant competitive edge in the realm of palm oil production, owing to its ample resources and highly efficient production methodologies (Lee & Lim, 2020).
2. Government Support and Policies: The Malaysian government helps and implements favourable policies in order to foster the growth and development of the palm oil industry (Shehu & Salleh, 2020).

3. Diversified Product Range: The Malaysian industry presents a wide array of palm oil products that cater to diverse markets and consumer demands.
4. Established Infrastructure: Malaysia has a highly developed infrastructure that encompasses processing facilities, transportation networks, and logistics, all of which contribute to the efficient operation of the palm oil supply chain.
5. Strong Research and Development: Malaysia places significant emphasis on research and development endeavours, fostering a culture of innovation and ongoing enhancement within its industrial sector (Nikoloyuk et al., 2010).

Internal Weaknesses:

1. Environmental Concerns: The palm oil industry in Malaysia has been subject to criticism and raised concerns pertaining to deforestation, habitat destruction, and environmental sustainability (Nor Ahmad, Amran, & Siti-Nabiha, 2022).
2. Dependency on Export Markets: The industry exhibits a significant dependence on export markets, rendering it susceptible to fluctuations in worldwide demand and market dynamics (Shehu & Salleh, 2020).
3. Labour Issues: The industry may encounter labor-related difficulties that can have an effect on productivity and efficiency (Abideen et al., 2023).
4. Price Volatility: The palm oil industry's profitability and stability can be influenced by the volatility of palm oil prices.
5. Limited Value Addition: The industry exhibits a restricted capacity for value addition, suggesting a potential deficiency in the processing and augmentation of palm oil products (Shehu & Salleh, 2020).

The IFE matrix allocates a rank and weighted score to each factor, considering its perceived significance. The rank signifies the comparative significance of the factor, whereas the weighted score denotes its tangible contribution to the overall performance. Irrespective of the number of factors considered in the IFE Matrix, the cumulative weighted score can vary between 1.0 and 4.0, with an average score of 2.5. The palm oil supply chain in Malaysia has received a total weighted score of 2.65 out of 4, indicating the presence of potential areas for enhancement and the need to address the internal weaknesses that have been identified. As a result, this suggests that the internal position of the palm oil supply chain in Malaysia can be classified as moderate.

The IFE matrix functions as an initial step in strategic analysis and decision-making processes, aiding stakeholders in comprehending internal dynamics and identifying areas in need of attention or potential exploitation. Through the assessment of internal strengths and weaknesses, organisations have the ability to develop strategies that capitalise on their strengths and address or overcome their weaknesses. This process ultimately results in improved competitiveness and the achievement of sustainable growth.

EXTERNAL FACTOR EVALUATION [EFE] MATRIX

PALM OIL SUPPLY CHAIN IN MALAYSIA

The External Factor Evaluation (EFE) matrix is a strategic management tool that is employed to assess the external opportunities and threats that a company or industry encounters. In the present scenario, this methodology is being employed to evaluate the palm oil supply chain in Malaysia. The EFE matrix is a tool that evaluates the significant external factors and their influence on the industry's overall performance.

KEY EXTERNAL FACTORS- *EXTERNAL OPPORTUNITIES*	SIGNIFICANT FACTOR / WEIGHT	RATING / RANK	WEIGHTED SCORE
1. Sustainable Practices	0.1	4	0.40
2. Growing Global Demand	0.2	3	0.60
3. Research and Development for New Applications	0.05	3	0.15
4. Technological Advancements	0.1	4	0.40
5. Public-Private Collaboration	0.2	3	0.60
KEY EXTERNAL FACTORS- *EXTERNAL THREATS*			
1. Sustainability Regulations and Certification	0.2	4	0.80
2. Competition from Other Vegetable Oils	0.1	3	0.30
3. Trade Barriers and Protectionism	0.1	3	0.30
4. Changing Consumer Preferences	0.05	3	0.15
5. Climate Change and Weather Volatility	0.05	2	0.10
TOTAL	**1.00**		**3.8**

EFE Rating Factors:1= The response is poor; 2= The response is average; 3= The response is above average; 4= The response is superior

External Opportunities:

1. Sustainable Practices (4 - The response is superior): The increasing significance of sustainability offers a favourable prospect for the palm oil sector in Malaysia to demonstrate its dedication to sustainable methodologies and attain a competitive advantage (Abideen et al., 2023).
2. Growing Global Demand (3 - The response is above average): The palm oil industry has the potential to leverage the increasing worldwide demand for edible oils and associated products, thereby offering prospects for expansion and market development.
3. Research and Development for New Applications (3 - The response is above average): Investment in research and development endeavours aimed at exploring novel applications for palm oil has the potential to facilitate the expansion of markets and generation of additional revenue streams within the industry.
4. Technological Advancements (4 - The response is superior): The integration of technological advancements in production, processing, and supply chain management has the potential to augment efficiency, productivity, and competitiveness within the palm oil supply chain (Sivan et al., 2023).
5. Public-Private Collaboration (3 - The response is above average): Establishment of a collaborative framework between the government and private sector has the potential to facilitate the advancement of innovation, investment, and policy support. This collaborative approach can contribute to the creation of a favourable environment that promotes the expansion and development of the palm oil industry.

External Threats:

1. Sustainability Regulations and Certification (4 - The response is superior): The industry faces a challenge due to the presence of rigorous sustainability regulations and certification requirements, which demand compliance and may result in additional costs.
2. Competition from Other Vegetable Oils (3 - The response is above average): The palm oil industry encounters competition from alternative vegetable oils, such as soybean oil, necessitating the adoption of strategic positioning and differentiation strategies.
3. Trade Barriers and Protectionism (3 - The response is above average): The imposition of trade barriers and protectionist measures by specific nations can impede market entry and have an impact on the global trade of the palm oil industry (Hassan & Lim, 2019).

4. Changing Consumer Preferences (3 - The response is above average): Shifting consumer preferences towards healthier and more sustainable alternatives have the potential to significantly influence the demand for palm oil products, thereby requiring companies to adapt and engage in product innovation (Zailani et al., 2023).
5. Climate Change and Weather Volatility (2 - The response is average): The production and supply of palm oil can be affected by climate change and the resulting volatility in weather patterns, including the occurrence of extreme weather events. Therefore, it becomes necessary to implement measures of adaptation and resilience in order to mitigate these impacts (Ng & Tan, 2018).

The EFE matrix evaluates and assigns a rating and weighted score to each factor, taking into consideration its perceived significance and the industry's corresponding response. Irrespective of the quantity of significant opportunities and threats incorporated in the EFE Matrix, the maximum attainable total weighted score for an organisation is 4.0, while the minimum attainable total weighted score is 1.0. The mean value of the total weighted scores is 2.5. The palm oil supply chain in Malaysia has achieved a total weighted score of 3.8 out of 4. This score indicates that there exist noteworthy prospects to exploit and challenges to mitigate. Consequently, it can be inferred that the palm oil supply chain in Malaysia surpasses the average performance in its endeavours to pursue strategies that leverage external opportunities and mitigate threats.

The EFE matrix functions as a strategic instrument for the identification of external opportunities that can be capitalised upon, as well as threats that necessitate mitigation or transformation into opportunities. Through a thorough understanding and adept response to the external environment, stakeholders possess the ability to formulate strategies that optimise opportunities and mitigate the adverse effects of threats. In turn, this facilitates enhanced competitiveness and sustainable growth within the palm oil supply chain in Malaysia.

While carrying out an analysis of the supply chain, an evaluation of its strengths, weaknesses, opportunities, and threats can be undertaken. Following that, a strategy can be developed, taking into account each of these aforementioned factors. In this context, the designed strategies are referenced in Table 3.

Table 3. The designed strategies of the Palm Oil Supply Chain

		Strengths (S1, S2, S3, S4, S5)		**Weaknesses (W1, W2, W3, W4, W5)**
Opportunities (O1, O2, O3, O4, O5)		***Offensive Strategy (SO)***		***Conservative Strategy (WO)***
	SO1	Promote sustainable palm oil globally and diversify offerings to reduce dependence on a single product.	WO1	Address the industry's environmental impact through certified sustainable palm oil to meet sustainability demands and regulations.
	SO2	Government supports palm oil industry growth with policies, incentives, and regulations, diversifying revenue through R&D in biofuels, cosmetics, and pharmaceuticals.	WO2	The industry faces criticism, stricter regulations due to environmental impact, improve by leveraging technology improves palm oil supply chain.
	SO3	Use government support to capitalize on growing global demand by implementing an export market expansion strategy with incentives, promotion, and development programs	WO3	Improve and develop human resources to enhance labour reputation.
	SO4	Efficient infrastructure and tech integration optimize the palm oil supply chain for seamless global distribution.	WO4	Leveraging technology in the palm oil supply chain boosts efficiency while investing in processing adds value and reduces reliance on commodity prices.
	SO5	Collaborative efforts drive the palm oil industry's global competitiveness, sustainability, labour standards, and enhanced reputation through innovation	WO5	Collaboration among the public, industry, and NGOs is crucial to promote sustainability, address labour issues, and protect reputation in the palm oil industry.

		Competitive Strategy (ST)		***Defensive Strategy (WT)***
Threats (T1, T2, T3, T4, T5)	ST1	Enhancing competitive advantage through sustainable practices leveraging established facilities and modern technology.	WT1	Improve structure and process to access the market by improving the worker reputation
	ST2	Efficient supply chains and conditions boost palm oil production to shifts influence demand.	WT2	Closure of raw palm oil export by producing finished goods to overcome trade barriers.
	ST3	Government supports growth with policies, incentives, and regulations to reduce trade barriers	WT3	Mitigate environmental concerns: Enhance reputation, and secure market access through sustainable practices.
	ST4	Negative perception is overcome with innovation to increase industry growth and competitiveness.	WT4	Initiatives to mitigate environmental concerns and capitalize on climate change disrupts,
	ST5	Climate change disrupts palm oil production, raising costs; infrastructure ensures efficient distribution.	WT5	Enhancing competitive advantage through sustainable practices leveraging established positive perceptions and campaigns

In line with the strategies mentioned in Table 3, each of the strategies is described and interpreted below:

SO1. **Promote sustainable palm oil globally and diversify offerings to reduce dependence on a single produc**: The objective is to advance the global adoption of sustainable palm oil, thereby ensuring the implementation of responsible production methods that safeguard the environment and foster the well-being of local communities. Through the process of diversifying our offerings, we have the potential to decrease our dependence on a solitary product, thereby promoting economic stability and mitigating the adverse effects on the environment. Let us collectively adopt a sustainable approach and endeavour to establish a future in which the coexistence of palm oil production and biodiversity flourishes in a harmonious manner**.**

SO2. **Government supports palm oil industry growth with policies, incentives, and regulations, diversifying revenue through R&D in biofuels, cosmetics, pharmaceuticals:** The government is proactively supporting the expansion of the palm oil industry through the implementation of favourable policies, incentives, and regulations. In addition, the company is allocating resources towards research and development endeavours aimed at investigating the potential applications of palm oil in the fields of biofuels, cosmetics, and pharmaceuticals. This strategic approach serves to broaden the company's sources of income.

SO3. **Use government support to capitalize on growing global demand by implementing an export market expansion strategy with incentives, promotion, and development programs:** By utilising the assistance provided by the government, the palm oil industry aims to exploit the growing worldwide demand. In order to accomplish this objective, it is imperative to implement a strategy for expanding the export market. This strategy should be reinforced by the provision of incentives, promotion campaigns, and development programmes. These initiatives are expected to facilitate the industry's access to untapped markets and enhance its export capabilities.

SO4. **Efficient infrastructure and tech integration optimize palm oil supply chain for seamless global distribution:** The palm oil industry is currently focusing on enhancing its supply chain by implementing efficient infrastructure and integrating advanced technology. By implementing this approach, it becomes possible to attain a smooth worldwide distribution of palm oil products, thereby guaranteeing punctual delivery and mitigating logistical obstacles.

SO5. Collaborative efforts drive palm oil industry's global competitiveness, sustainability, labour standards, and enhanced reputation through innovation: Acknowledging the significance of collaboration, the palm oil industry is actively participating in collective endeavours aimed at augmenting its global competitiveness, sustainability, labour standards, and reputation through innovative approaches. Through collaborative efforts, various stakeholders within the industry are actively facilitating constructive transformations and establishing novel standards within the palm oil sector**.**

ST1. Enhancing competitive advantage through sustainable practices leveraging established facilities and modern technology: By implementing sustainable practises and integrating advanced technology into our current infrastructure, we aim to strengthen our competitive edge. This approach enables individuals to maintain a competitive advantage while simultaneously making contributions towards a more sustainable future.

ST2. Efficient supply chain and conditions boost palm oil production to shifts influence demand: Improved supply chain optimisation and favourable circumstances play a significant role in augmenting palm oil production, thereby exerting an influence on and satisfying the escalating demand. By utilising these factors, adeptly address market dynamics and sustain a competitive advantage.

ST3. Government supports growth with policies, incentives, and regulations to reduce trade barriers: By means of governmental assistance in the form of favourable policies, incentives, and regulations, efforts are made to address and overcome obstacles in international trade. This support facilitates the growth of industries by creating a favourable environment for businesses to flourish and enhance their operations in an effort to capture market opportunities.

ST4. Negative perception overcome with innovation to increase industry growth and competitiveness: Negative perceptions can be effectively addressed through the active adoption of innovative practises within the industry. By implementing novel concepts and strategies, we can stimulate economic expansion and augment our capacity to compete, thereby reshaping the discourse pertaining to the cultivation of palm oil.

ST5. Climate change disrupts palm oil production, raising costs; infrastructure ensures efficient distribution: The phenomenon of climate change presents significant obstacles to the production of palm oil, resulting in escalated financial burdens. Nevertheless, through the allocation of resources towards the development of resilient infrastructure, it is possible to guarantee the effective dissemination of palm oil, thereby minimising the consequences of climate-induced disturbances and upholding a dependable logistical network.

WO1. Address industry's environmental impact through certified sustainable palm oil to meet sustainability demands and regulations: The consideration of the environmental impact within the industry is of utmost importance in order to fulfil sustainability requirements and comply with regulations. The adoption of certified sustainable palm oil by companies enables them to actively contribute towards the mitigation of adverse effects and the promotion of a more sustainable approach to the production of palm oil.

WO2. Industry faces criticism, stricter regulations due to environmental impact, improve by leveraging technology improves palm oil supply chain: The environmental ramifications of the industry have resulted in scrutiny and the implementation of more stringent regulations.

The incorporation of technological advancements can enhance the efficiency and effectiveness of the palm oil supply chain, leading to increased transparency, traceability, and adherence to sustainable practises. This, in turn, can effectively address the concerns and fulfil the demands of both consumers and regulatory bodies.

WO3. Improve and develop human resource to enhance labour reputation: To bolster the standing of labour within the palm oil sector, it is imperative to prioritise the enhancement and cultivation of human resources. Companies have the capacity to enhance the overall perception of the industry by implementing measures such as offering appropriate training, ensuring fair wages, and promoting worker welfare (Vatumalae et al., 2023).

WO4. Leveraging technology in palm oil supply chain boosts efficiency while investing in processing adds value and reduces reliance on commodity prices: The implementation of technology within the palm oil supply chain has the potential to enhance operational effectiveness. Through the strategic allocation of resources towards enhancing processing capabilities, companies have the potential to augment the worth of their products while simultaneously mitigating their dependence on fluctuating commodity prices. This, in turn, facilitates the establishment of a more resilient and enduring business framework**.**

WO5. Collaboration among public, industry, and NGOs crucial to promote sustainability, address labour issues, and protect reputation in palm oil industry: The reinforcement of sustainability in the palm oil industry necessitates the imperative collaboration among the public sector, industry stakeholders, and non-governmental organisations (NGOs). Through collaborative efforts, stakeholders have the capacity to effectively tackle labour concerns, promote responsible production methodologies, and safeguard the integrity of the palm oil industry. Consequently, these endeavours can lead to the realisation of a palm oil sector that is both sustainable and ethically sound.

WT1. Improve structure and process to access market by improving the worker reputation: In order to enhance market access, it is imperative to bolster worker reputation through the implementation of more robust structures and processes. This encompasses the promotion of professionalism, the development of skills, and the adherence to ethical conduct, thereby fostering trust and establishing credibility among prospective customers and partners.

WT2. Closure of raw palm oil export by producing finish good to overcome trade barriers: The process of dealing with trade barriers involves the cessation of raw palm oil exports and the shift towards the manufacturing of finished goods. By enhancing the quality and utility of palm oil products through refining processes, the company can effectively overcome trade restrictions and effectively penetrate new markets.

WT3. Mitigate environmental concerns: Enhance reputation, secure market access through sustainable practices: In order to effectively respond to environmental concerns and ensure market access, the adoption of sustainable practises is of utmost importance. This will not only bolster the company's standing but also appeal to consumers who prioritise environmental sustainability. By implementing strategies to reduce its ecological footprint and advocating for responsible business practises, the company can enhance its prospects for success in a highly competitive market.

WT4. Initiatives to mitigate environmental concerns and capitalize on climate change disrupts: Harnessing the opportunities presented by climate change disruptions necessitates the implementation of proactive measures aimed at mitigating environmental concerns. Through the adoption of sustainable practises, such as the mitigation of carbon emissions, resource preservation, and the endorsement of renewable energy sources, the company can establish itself as a frontrunner within the industry, thereby appealing to environmentally aware consumers and investors.

WT5. Enhancing competitive advantage through sustainable practices leveraging established positive perception and campaigns: By capitalising on existing favourable perceptions and initiatives related to sustainable practises, the organisation can strengthen its competitive edge. This entails the demonstration of continuous sustainability initiatives, the promotion of environmentally friendly products, and the communication of the company's dedication to environmental responsibility. These actions are expected to resonate with customers and establish a distinctive position for the company in relation to its competitors.

Table 4 is presented to facilitate the prioritisation of strategies based on the Quantitative Strategic Planning Matrix (QSPM). The presented table provides an overview of the Quantitative Strategic Planning Matrix (QSPM) for Offensive Strategies (SO), Competitive Strategies (ST), Conservative Strategies (WO), and Defensive Strategies (WT).

Table 4. QSPM for (a) offensive strategies, (b) competitive strategies, (c) conservative strategies, (d) defensive strategies

a) Offensive Strategy												b) Conservative Strategy											
		SO1		SO2		SO3		SO4		SO5				WO1		WO2		WO3		WO4		WO5	
KEY FACTORS	**WEIGHT**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**KEY FACTORS**	**WEIGHT**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.2	3	0.6	3	0.6	1	0.2	3	0.6	3	0.6	S1	0.2	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6
S2	0.1	2	0.2	2	0.2	1	0.1	2	0.2	2	0.2	S2	0.1	1	0.1	2	0.2	1	0.1	2	0.2	2	0.2
S3	0.1	2	0.2	2	0.2	3	0.3	2	0.2	2	0.2	S3	0.1	1	0.1	2	0.2	1	0.1	2	0.2	2	0.2
S4	0.1	3	0.3	1	0.1	1	0.1	1	0.1	1	0.1	S4	0.1	3	0.3	4	0.4	4	0.4	1	0.1	3	0.3
S5	0.1	1	0.1	1	0.1	4	0.4	1	0.1	1	0.1	S5	0.1	2	0.2	1	0.1	2	0.2	4	0.4	1	0.1
W1	0.1	2	0.2	1	0.1	2	0.2	4	0.4	4	0.4	W1	0.1	3	0.3	3	0.3	3	0.3	1	0.1	4	0.4
W2	0.05	1	0.1	1	0.1	1	0.1	1	0.1	1	0.05	W2	0.05	4	0.2	1	0.05	2	0.1	4	0.2	4	0.2
W3	0.05	4	0.2	2	0.1	2	0.1	3	0.2	3	0.15	W3	0.05	3	0.15	4	0.2	3	0.15	2	0.1	3	0.15
W4	0.1	1	0.1	4	0.4	4	0.4	1	0.1	1	0.1	W4	0.1	2	0.2	1	0.1	4	0.4	1	0.1	4	0.4
W5	0.1	3	0.3	1	0.1	1	0.1	3	0.3	3	0.3	W5	0.1	4	0.4	3	0.3	3	0.3	4	0.4	3	0.3
O1	0.1	2	0.2	4	0.4	2	0.2	3	0.3	3	0.3	O1	0.1	1	0.1	4	0.4	1	0.1	4	0.4	3	0.3
O2	0.2	4	0.8	1	0.2	1	0.2	1	0.2	1	0.2	O2	0.2	2	0.4	1	0.2	2	0.4	1	0.2	1	0.2
O3	0.05	2	0.1	2	0.1	2	0.1	3	0.2	3	0.15	O3	0.05	1	0.05	3	0.15	1	0.05	2	0.1	4	0.2
O4	0.05	4	0.2	1	0.1	2	0.1	2	0.1	4	0.2	O4	0.05	1	0.05	1	0.05	4	0.2	4	0.2	4	0.2
O5	0.1	1	0.1	4	0.4	1	0.1	1	0.1	1	0.1	O5	0.1	2	0.2	3	0.3	2	0.2	1	0.1	3	0.3
T1	0.2	4	0.8	2	0.4	1	0.2	2	0.4	2	0.4	T1	0.2	4	0.8	2	0.4	4	0.8	4	0.8	4	0.8
T2	0.1	2	0.2	1	0.1	2	0.2	3	0.3	4	0.4	T2	0.1	1	0.1	1	0.1	1	0.1	1	0.1	1	0.1
T3	0.1	4	0.4	2	0.2	2	0.2	2	0.2	2	0.2	T3	0.1	1	0.1	2	0.2	1	0.1	2	0.2	2	0.2
T4	0.05	3	0.2	1	0.1	4	0.2	4	0.2	4	0.2	T4	0.05	3	0.15	2	0.1	3	0.15	4	0.2	2	0.1
T5	0.05	1	0.1	1	0.1	1	0.1	1	0.1	1	0.05	T5	0.05	2	0.1	1	0.05	2	0.1	1	0.05	1	0.05
Sum			5.25		3.90		3.50		4.20		4.40	Sum			4.60		4.40		4.85		4.75		5.30

c) Competitive Strategy												d) Defensive Strategy											
		ST1		ST2		ST3		ST4		ST5				WT1		WT2		WT3		WT4		WT5	
KEY FACTORS	**WEIGHT**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**KEY FACTORS**	**WEIGHT**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.2	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6	S1	0.2	3	0.6	3	0.6	3	0.6	3	0.6	3	0.6
S2	0.1	3	0.3	2	0.2	1	0.1	2	0.2	2	0.2	S2	0.1	2	0.2	1	0.1	2	0.2	2	0.2	2	0.2
S3	0.1	2	0.2	2	0.2	1	0.1	2	0.2	2	0.2	S3	0.1	2	0.2	1	0.1	2	0.2	2	0.2	2	0.2
S4	0.1	3	0.3	1	0.1	3	0.3	1	0.1	4	0.4	S4	0.1	1	0.1	3	0.3	3	0.3	3	0.3	3	0.3
S5	0.1	1	0.1	4	0.4	4	0.4	4	0.4	1	0.1	S5	0.1	4	0.4	2	0.2	1	0.1	1	0.1	1	0.1
W1	0.1	3	0.3	1	0.1	3	0.3	1	0.1	3	0.3	W1	0.1	4	0.4	3	0.3	4	0.4	3	0.3	3	0.3
W2	0.05	4	0.2	4	0.2	2	0.1	4	0.2	1	0.05	W2	0.05	1	0.05	2	0.1	1	0.05	4	0.2	4	0.2
W3	0.05	3	0.2	2	0.1	3	0.2	2	0.1	4	0.2	W3	0.05	4	0.2	3	0.15	1	0.05	3	0.15	3	0.15
W4	0.1	1	0.1	1	0.1	2	0.2	4	0.4	1	0.1	W4	0.1	1	0.1	2	0.2	1	0.1	1	0.1	1	0.1
W5	0.1	3	0.3	4	0.4	3	0.3	1	0.1	3	0.3	W5	0.1	4	0.4	3	0.3	3	0.3	4	0.4	4	0.4
O1	0.1	3	0.3	4	0.4	1	0.1	4	0.4	4	0.4	O1	0.1	4	0.4	4	0.4	3	0.3	3	0.3	3	0.3
O2	0.2	4	0.8	1	0.2	2	0.4	1	0.2	1	0.2	O2	0.2	1	0.2	2	0.4	1	0.2	1	0.2	1	0.2
O3	0.05	3	0.2	2	0.1	1	0.1	4	0.2	3	0.15	O3	0.05	2	0.1	4	0.2	1	0.05	4	0.2	4	0.2
O4	0.05	4	0.2	4	0.2	1	0.1	1	0.1	1	0.05	O4	0.05	4	0.2	1	0.05	1	0.05	4	0.2	1	0.05
O5	0.1	3	0.3	1	0.1	4	0.4	1	0.1	3	0.3	O5	0.1	1	0.1	4	0.4	1	0.1	3	0.3	3	0.3
T1	0.2	2	0.4	4	0.8	2	0.4	2	0.4	2	0.4	T1	0.2	2	0.4	4	0.8	2	0.4	2	0.4	2	0.4
T2	0.1	4	0.4	1	0.1	3	0.3	4	0.4	1	0.1	T2	0.1	4	0.4	1	0.1	1	0.1	1	0.1	1	0.1
T3	0.1	2	0.2	2	0.2	1	0.1	2	0.2	2	0.2	T3	0.1	2	0.2	1	0.1	2	0.2	2	0.2	2	0.2
T4	0.05	2	0.1	4	0.2	3	0.2	1	0.1	2	0.1	T4	0.05	4	0.2	3	0.15	2	0.1	2	0.1	4	0.2
T5	0.05	1	0.1	1	0.1	2	0.1	1	0.1	1	0.05	T5	0.05	1	0.05	4	0.2	1	0.05	1	0.05	1	0.05
Sum			5.45		4.75		4.60		4.45		4.40	Sum			4.90		5.15		3.85		4.60		4.55

Table 5 presents a comprehensive summary of the weight assigned to each of the prioritised strategies. According to the findings, the priority of activating competitive advantage is achieved by implementing sustainable practises and utilising both established facilities and modern technology. This particular approach is employed in scenarios where the supply chain is actively pursuing competitive strategies. Collaboration between public entities, industry stakeholders, and non-governmental organisations (NGOs) plays a vital role in advancing sustainability, tackling labour concerns, safeguarding the reputation of the palm oil industry, and diversifying product offerings to reduce reliance on a single commodity. These strategies, with attractiveness scores of 5.30 and 5.25, respectively, are ranked as the second and third priorities. These two strategies can be rationalised as competitive strategies that hold greater strategic significance. Conversely, these strategies were present within the realms of conservatism and offensiveness, thereby underscoring the significant value attributed to this particular strategy. Furthermore, the strategy of utilising government support to leverage the increasing global demand, which has the lowest attractiveness score, ranks last.

Table 5. Prioritise strategies based on QSPM results.

Strategies	Attractiveness Score (SUM)	Priority
SO1	5.25	3
SO2	3.90	18
SO3	3.50	3
SO4	4.20	17
SO5	4.40	14
WO1	4.60	10
WO2	4.40	15
WO3	4.85	6
WO4	4.75	7
WO5	5.30	2
ST1	5.45	1
ST2	4.75	7
ST3	4.60	10
ST4	4.45	13
ST5	4.40	15
WT1	4.90	5
WT2	5.15	4
WT3	3.85	19
WT4	4.60	9
WT5	4.55	12

CONCLUSION

This research paper examines the adverse perceptions and obstacles encountered by the palm oil industry, with a specific emphasis on environmental apprehensions, sustainability dilemmas, and more stringent regulatory measures. The absence of effective collaboration among the public sector, industry stakeholders, and non-governmental organisations (NGOs) within the supply chain has resulted in the emergence of trade barriers that impede market access. The objective of this study is to formulate an all-encompassing strategic plan aimed at addressing the aforementioned issues. Qualitative research methods were utilised in this study to ascertain the strengths, weaknesses, opportunities, and threats (SWOT) present within the supply chain of the Malaysian palm oil industry. The SWOT-Quantitative Strategic Planning Matrix (QSPM) technique was subsequently employed to evaluate the strategies pertaining to these factors. The results of the study indicate that Malaysia possesses favourable conditions and an efficient supply chain, which contribute to its status as a leading producer of palm oil. This characteristic can be considered a significant advantage for the country. Nevertheless, the environmental impact of the industry has given rise to criticism, posed challenges to sustainability, and led to the implementation of more stringent regulations, thereby becoming a notable weakness. The most highly regarded opportunity entails the promotion of certified sustainable palm oil in order to address the growing global sustainability requirements. On the contrary, the primary challenge faced by the industry pertains to the restricted accessibility of palm oil resulting from increasingly stringent regulations, specifically impacting Malaysian producers. Through an analysis of attractiveness scores pertaining to both internal and external factors, this study discerns that diversity and competitive strategies exhibit a greater degree of importance. According to the QSPM analysis, prioritising the activation of existing infrastructure emerges as the strategy of utmost importance. The findings underscore the significance of harnessing sustainable practises via well-established infrastructures and contemporary technology in order to stimulate the industry's competitive edge. The promotion of sustainability, addressing labour issues, and safeguarding the reputation of the industry necessitate essential collaboration among the public, industry, and non-governmental organisations (NGOs). Furthermore, it is advised to diversify

the range of products in order to decrease reliance on a singular product. These strategies are in accordance with competitive strategies and possess substantial strategic significance. Furthermore, they strategically occupy areas that are both conservative and offensive, thereby emphasising their significant level of importance. On the other hand, the approach of leveraging government assistance to exploit the increasing global demand is deemed the least appealing, occupying the final position in the ranking. The study presents an all-encompassing strategic blueprint for the palm oil sector, encompassing environmental considerations, obstacles to sustainability, and impediments to trade. By prioritising sustainable practises, fostering collaboration, and embracing diversification, the industry can effectively address these challenges and bolster its competitiveness within the global market.

SUGGESTIONS FOR FUTURE RESEARCH

Future research should prioritise the assessment of the sustained effectiveness of the all-encompassing strategic plan put forth for the palm oil sector. Longitudinal studies offer significant contributions by providing valuable insights into the enduring effects of the plan's implementation and its outcomes over an extended duration. Key areas for further investigation include the assessment of economic and social impacts, exploration of innovative technologies, understanding of consumer behaviour, conducting comparative analyses of certification programmes, and examination of policy frameworks. In terms of economic and social ramifications, researchers have the ability to examine the consequences of the strategic plan on nearby communities, employment prospects, the distribution of income, and the broader advancement of the economy. The aforementioned analysis would enhance the overall comprehension of the plan's wider ramifications and provide valuable guidance for future decision-making endeavours.

Moreover, conducting a comparative analysis encompassing various certification programmes, including RSPO, ISCC, and other relevant initiatives, can yield valuable insights into the distinct advantages, limitations, and effects they have on promoting sustainable practises. This analysis has the potential to facilitate the identification of optimal strategies, areas requiring enhancement, and potential initiatives for aligning certification standards in the palm oil sector in order to enhance their effectiveness. Furthermore, a comprehensive analysis of policy and regulatory frameworks is imperative in order to effectively uphold and propel sustainable practises within the industry. Research plays a crucial role in evaluating the efficacy of current policies and regulations, identifying any deficiencies or obstacles, and presenting suggestions to improve governance and guarantee the enduring viability of palm oil production. By examining these research domains, future investigations can enhance our comprehension of the challenges and prospects within the palm oil industry. This study aims to generate empirically-supported insights and suggestions for bolstering sustainability, mitigating negative perceptions, and effectively managing trade barriers within the industry.

Acknowledgement: This work was supported by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [Grant 3951]'.

Acknowledgments: We express our sincere appreciation to the Malaysian Ministry of Education and the Institute of Research Management & Innovation (IRMI), UiTM Shah Alam for their indispensable assistance in facilitating the execution of this research. The research project was facilitated by the Strategic Research Partnership Grant (SRP) bestowed by UiTM Selangor [Project code: 600-RMC 5/3/SRP (059/2022)].

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APPENDIX A

The internal and external sub-criteria affecting the Supply Chain are as follows:

Strengths:

S1: Abundant and Efficient Production: Malaysia is one of the world's largest producers of palm oil, with a well-established and efficient supply chain. The country has a favourable climate and fertile land, which contribute to high yields and cost-effective production.
S2: Government Support and Policies: The Malaysian government has implemented supportive policies and initiatives to promote the growth of the palm oil industry. This includes financial incentives, subsidies, and favourable regulations, creating a conducive environment for industry players.
S3: Diversified Product Range: Malaysia has successfully diversified its palm oil product range to include not only crude palm oil but also refined products such as palm olein, palm stearin, and palm kernel oil. This diversification allows for a wider customer base and reduces dependence on a single product.
S4: Established Infrastructure: Malaysia has a robust infrastructure network, including well-connected roads, ports, and logistics facilities. This facilitates smooth transportation and distribution of palm oil products both domestically and internationally.
S5: Strong Research and Development: The palm oil industry in Malaysia benefits from a strong focus on research and development. Continuous efforts are made to improve cultivation techniques, increase productivity, and develop innovative uses for palm oil, enhancing its competitiveness in the global market.

Weaknesses:

W1: Environmental Concerns: The palm oil industry faces criticism regarding deforestation, habitat destruction, and greenhouse gas emissions associated with land clearing. These concerns have led to sustainability challenges and stricter regulations in some markets, impacting the industry's reputation.
W2: Dependency on Export Markets: Malaysia heavily relies on international markets for palm oil export. Fluctuations in global demand, trade barriers, and geopolitical factors can affect the industry's profitability and stability, making it vulnerable to external shocks.
W3: Labour Issues: The palm oil industry in Malaysia has faced scrutiny related to labour practices, including allegations of unfair wages, poor working conditions, and exploitation of migrant workers. These issues can tarnish the industry's image and lead to reputational risks.
W4: Price Volatility: Palm oil prices are subject to high volatility due to factors like weather conditions, global demand-supply dynamics, and policy changes. Such price fluctuations can impact profitability and financial stability for palm oil producers and traders.
W5: Limited Value Addition: Malaysia primarily exports raw palm oil, which limits the potential for value addition and higher profit margins. The industry could benefit from more investments in downstream processing facilities to produce higher-value products and reduce reliance on commodity pricing.

Opportunities:

O1: Sustainable Practices: The increasing global awareness of environmental and sustainability concerns has created a demand for sustainable palm oil. Malaysia can seize this opportunity by promoting and certifying sustainably produced palm oil to cater to conscious consumers and meet sustainability requirements in key markets.

O2: Growing Global Demand: The global demand for Palm oil is increasing due to factors such as urbanization, population growth, and rising disposable incomes. Malaysia can tap into these opportunities to expand its export market share.
O3: Research and Development for New Applications: Continued research and development efforts can unlock new applications for palm oil in industries such as biofuels, personal care products, and pharmaceuticals. Diversifying the uses of palm oil can create new revenue streams and reduce dependence on traditional markets.
O4: Technological Advancements: Leveraging technology can enhance productivity, traceability, and efficiency in the palm oil supply chain. Automation, data analytics, and precision farming techniques can optimize plantation management, improve yield, and reduce costs.
O5: Public-Private Collaboration: Collaboration between government, industry players, and NGOs can drive sustainable practices, address labor issues, and enhance the industry's overall reputation. Public-private partnerships can also foster innovation, attract investments, and support the development of a more sustainable and competitive palm oil industry.

Threats:

T1: Sustainability Regulations and Certification: Stricter sustainability regulations and certification requirements imposed by importing countries can limit market access for palm oil products. Compliance with these standards and maintaining certification can pose challenges for Malaysian producers.
T2: Competition from Other Vegetable Oils: Palm oil faces competition from other vegetable oils, such as soybean oil, sunflower oil, and rapeseed oil. Shifts in consumer preferences or changes in import policies of key markets can impact demand for palm oil and create market share challenges.
T3: Trade Barriers and Protectionism: Trade barriers, import restrictions, and protectionist policies implemented by countries can hinder the palm oil industry's access to key markets. Tariffs, anti-dumping measures, or trade disputes can disrupt trade flows and affect the industry's profitability.
T4: Changing Consumer Preferences: Negative consumer perception and campaigns against palm oil's environmental and health impacts can influence consumer choices and product preferences. Misinformation and negative publicity can erode market demand and hinder the industry's growth.
T5: Climate Change and Weather Volatility: Climate change-related factors, such as extreme weather events, prolonged droughts, or heavy rainfall, can impact palm oil production. Unpredictable weather patterns can disrupt supply, affect crop yields, and increase production costs for industry players.