



Charting a Thriving Path for the Malaysian Palm Oil Supply Chain: A SWOT-QSPM-Powered Strategic Roadmap

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Abstract

Purpose: The purpose of this article is to examine the supply chain issues in the palm oil industry in Malaysia and by proposing a comprehensive and strategic plan. **Research design, data and methodology:** Through meticulous qualitative analysis, we have identified the strengths, weaknesses, opportunities, and threats (SWOT) affecting the Malaysian palm oil supply chain. Leveraging the SWOT-Quantitative Strategic Planning Matrix (QSPM), we have critically assessed a range of strategies. **Results:** Our findings have underscored the supply chain's robust infrastructure and efficient operations as significant strengths, while environmental impact and distribution concerns emerged as notable weaknesses. The study highlights the promotion of certified sustainable palm oil to meet global demands as the most promising opportunity, juxtaposed against stricter regulations hampering market access as the primary threat. Remarkably, the QSPM has singled out the activation of existing infrastructure as the top priority. **Conclusions:** This study contributes substantially to the field by offering an in-depth analysis and improvement blueprint specifically tailored to the palm oil supply chain. In light of prevailing negative perceptions, distribution campaigns, and trade hurdles, businesses can harness the strategic insights presented here to unlock the full potential of the supply chain and steer it towards sustainable prosperity.

Keywords: Distribution, Palm Oil Supply chain, sustainable supply chain, SWOT-QSPM technique, IFE and EFE Matrix.

JEL Classification Code: R41, N55, O13

1. Introduction

The network of organisations, people, activities, information, and resources involved in the manufacturing, distribution, and delivery of goods or services to the end consumer is referred to as a supply chain.

It includes all of the actions and procedures that occur between the procurement of raw materials and the final consumption of a product or service. A supply chain's fundamental purpose is to guarantee that the correct product or service is delivered at the correct location, at the correct time, in the correct amount, and at the correct cost (Ibragimov et al., 2019). Coordination and integration of

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numerous operations such as procurement, production, logistics, transportation, warehousing, and distribution are required.

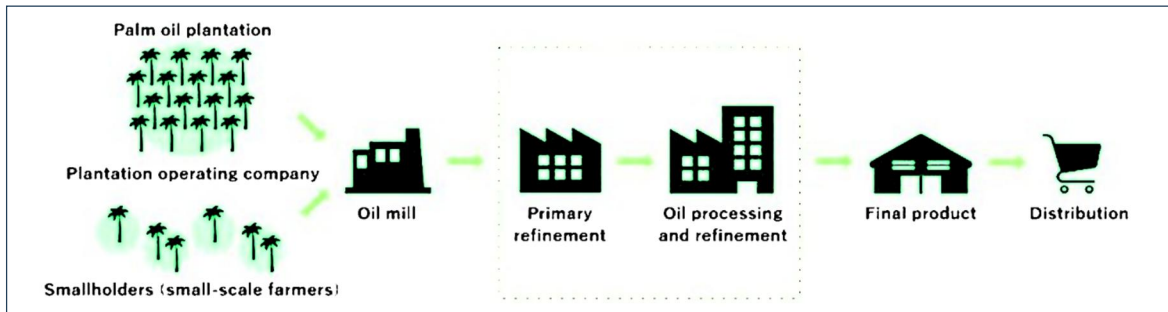
Similarly, the palm oil supply chain also includes numerous phases, such as from the plantation to the mill, then to the refinery for additional chemical processing and manufacture, and lastly to the goods we use every day. Commercial oil palm planting increased rapidly in Southeast Asia in the mid-twentieth century, owing to rising worldwide demand (Lim & Biswas, 2019). Plantations were expanded on a bigger scale, and manufacturing methods were refined to satisfy the expanding demands of diverse sectors.

Palm oil became popular owing to its distinct properties, such as high production per unit of land, adaptability in a variety of uses, and inexpensive cost in comparison to other

vegetable oils. It quickly became a favourite for cooking oil, food processing, cosmetics, detergents, and biofuels (Amindoust et al., 2012). As worldwide demand for palm oil grew, the industry's supply chain expanded and became increasingly intertwined. Palm oil became a major traded commodity, with considerable amounts shipped from major producing nations, mainly Indonesia and Malaysia, to other global areas.

Concerns have been made regarding the palm oil industry's environmental effect, which includes deforestation, biodiversity loss, and greenhouse gas emissions. Land rights, labour practices, and indigenous groups have all received more attention (Uthayakumar & Thong, 2017). These problems have prompted greater scrutiny and requests for the palm oil supply chain to be more sustainable.

PALM OIL SUPPLY CHAIN IN MALAYSIA



Source: Authors compilation

Figure 1: Palm oil supply chain (Malaysia)

The palm oil supply chain in Malaysia is a complex network involving various stages, from cultivation and harvesting to processing and export as depicted in Figure 1. Malaysia is one of the largest producers and exporters of palm oil globally. Firstly, cultivation and plantation. Oil palm cultivation involves planting oil palm trees in large plantations. These plantations are typically owned by plantation companies or smallholders. The cultivation process includes land preparation, planting of oil palm seedlings, and maintenance of palm trees through fertilisation, pest control, and harvesting (Basiron, 2008). Smallholders play a significant role in Malaysia's palm oil industry, with many of them owning small plots of land where they cultivate oil palm. Then comes harvesting and collection. Oil palm trees start producing fresh fruit bunches (FFBs) after around three years (Vijayakumaran et al., 2020). These FFBs are harvested from the plantations. Harvesting of FFBs involves cutting the bunches from the trees using machetes or specialised tools. Once harvested, the FFBs are collected and transported to the nearest palm oil mills. Then there are palm oil mills. Palm oil mills process the FFBs to extract crude palm oil (CPO) and palm kernel oil (PKO)

(Basiron, 2008). The FFBs are sterilised, threshed, and then pressed to separate the palm oil from the palm kernels. The extracted oils undergo further processing, including clarification, purification, and drying.

Next, refining and fractionation. Crude palm oil produced at the mills is sent to refineries for further processing. Refineries remove impurities and unwanted components from the CPO, resulting in refined, bleached, and deodorised palm oil (RBDPO) (Guan et al., 2016). Fractionation is an optional process where the RBDPO is separated into different fractions, such as palm olein and palm stearin, to meet specific market requirements. Finally, there is storage and distribution. Palm oil products are stored in tanks or containers after processing before being delivered (Yahya et al., 2022). Malaysia has a well-developed palm oil logistics and transportation infrastructure, including ports, highways, and rail networks. The palm oil products are typically exported to various destinations worldwide via shipping (Mukherjee et al., 2015). Saha et al. (2024) suggested a model that offers better degree of adaptability and flexibility in managing complexity in healthcare supplier choosing issues.

2. Literature Review

SWOT ANALYSIS OF PALM OIL INDUSTRY IN MALAYSIA

Table 1: The Internal and External Sub-criteria Affecting the Palm Oil Industry

Internal Factors Affecting the Industry					
Weakness			Strength		
W1	Environmental Issues, palm oil faces environmental criticism, consumer backlash, and governmental adjustments.		S1	Abundant and productive plantations, Malaysia's climate and abundant soil make palm oil cultivation possible.	
W2	Dependence on export markets, international markets affect Malaysia's palm oil export's profitability.		S2	Infrastructure in place, Malaysia's infrastructure streamlines palm oil production, delivery, and export.	
W3	Sustainability challenges, Respecting indigenous rights and land tenure in palm oil development.		S3	Global Market Dominance with Quality and Adaptability.	
W4	Price volatility, Managing Price Volatility in Palm Oil Industry: balancing inventory and market conditions.		S4	Economic contribution, palm oil affects Malaysia's economy, jobs, and foreign exchange revenues.	
External factors affecting the industry					
Threats			Opportunities		
T1	Competitor Countries, Malaysia competes with Indonesia, Thailand, and Colombia.		O1	Growing Demand, Malaysia seeks market share in rising vegetable oil consumption.	
T2	Negative Public Perception, environmental concerns drive palm oil boycotts, legislation, and demand.		O2	Value-Added Products, Enhancing Competitiveness of Malaysian Palm Oil.	
T3	Challenges in Consumer Preferences and Awareness: Implications for Palm Oil Sector.		O3	Enhancing Energy Security with Palm Oil-based Biofuels.	
T4	Land availability and conflicts, Challenges for Palm Oil Expansion.		O4	Advancing Quality Control in Palm Oil Manufacturing through Technology.	

3. Research Methods and Materials

ANALYSIS OF INTERNAL AND EXTERNAL FACTOR

Table 2: The Results of Prioritising the Sub-criteria of SWOT

Strengths	Weight	Priority	Weaknesses	Weight	Priority
S1	0.425	1	W1	0.235	3
S2	0.262	2	W2	0.247	2
S3	0.103	4	W3	0.305	1
S4	0.210	3	W4	0.213	4
Opportunities	Weight	Priority	Threats	Weight	Priority
O1	0.388	1	T1	0.411	1
O2	0.204	3	T2	0.117	3
O3	0.267	2	T3	0.358	2
O4	0.141	4	T4	0.114	4

From Table 1, in accordance to the relevant experts, it weighs 42.5%. Similarly, "Abundant and productive plantations" in the first place. "Infrastructure in place, Malaysia's infrastructure streamlines palm oil production, delivery, and export" with a weight of 26.2% in the second place. With a weight of 10.3% and the fourth place is "Global Market Dominance with Quality and Adaptability". The third place of 21% weighing is "Economic contribution".

The results of prioritising the sub-criteria related to weaknesses are given. According to the results of the table, it can be seen that the most important weakness of the company is the "Environmental Issues, palm oil faces environmental criticism, consumer backlash, and governmental adjustments" The importance of this factor is 23.5%. However, the lowest weight of weaknesses, according to experts, is related to "Price volatility, Managing Price Volatility in Palm Oil Industry" with a weight of 21.3% and "Dependence on export markets, international markets affect Malaysia's palm oil export's profitability" with a weight of 24.7%. The last factor of "quantitative and qualitative weakness of human resources" is in first place with weight of 22.6.

Based on the results, it can be said that the biggest opportunity for the company is "Growing Demand, Malaysia seeks market share in rising vegetable oil consumption.". Similarly, "Enhancing Energy Security with Palm Oil-based Biofuels." with a weight of 26.7% is in second place and "Value-Added Products, Enhancing Competitiveness of Malaysian Palm Oil" and "Advancing Quality Control in Palm Oil Manufacturing through Technology" jointly have the third and the fourth priority. According to the results of Table 2, it can be seen that the most important threat to the company is "Competitor Countries, Malaysia competes with Indonesia, Thailand,

and Colombia” because it has the highest weight amongst the desired sub-criteria.

Table 3: Analysis of the (a) Internal Factors (b) External Factors

Factors	Significant factor	Rank	Weighted score
(a) Internal factors			
Strengths			
S1	0.213	3.5	0.746
S2	0.131	4.0	0.524
S2	0.051	2.8	0.143
S4	0.105	3.0	0.315
Weaknesses			
W1	0.118	2.2	0.260
W2	0.123	1.5	0.185
W3	0.152	1.0	0.152
W4	0.107	1.7	0.182
SUM	1		2.507
(b) External			
Opportunities			
O1	0.194	2.9	0.563
O2	0.102	3.1	0.316
O3	0.134	3.9	0.523
O4	0.070	3.0	0.210
Threats			
T1	0.205	1.0	0.205
T2	0.059	1.7	0.100
T3	0.179	2.1	0.376
T4	0.057	1.4	0.080
SUM	1		2.373

Based on the Table 3, after calculating all the weight and the which one should be prioritised moved on to the Table 3 which the analysis of the internal and the external factor. Numbers get from Table 2. For Table 3, sum up all the strengths and weaknesses, it will get a 1 firm number and the same goes to the total of opportunities and threats. Strength and weaknesses each has four reasons and total of those strengths and weaknesses are 8. By dividing half of the total sum up which is one, strengths will get 4 out of 8 to calculate and get the significant factor. Just like strengths, weaknesses also get 4 out of 8 to get their significant factor. Simple and clear procedures are utilised for rating because the organisation hasn't yet evaluated internal and external elements; instead, it relies on the opinions of specialists and managers.

Then, a score of 1-4 is assigned to each of these factors. A score of 1 denotes a significant weakness, a score of 2 indicates a modest weakness, a score of 3 denotes the factor's strength, and a score of 4 indicates the factor's extreme strength. Weaknesses are given a rank of 1-2.5 among the internal components in this regard, whilst strengths are given a rank of 2.5-4. The same scoring system

is used for threats and opportunities. By multiplying a significant factor and the rank that has been calculated, the result of the multiplying will get a weighted score.

4. Results and Discussion

Table 4: The designed strategies of the industry

	Strength (S1, S2, S3, S4)	Weakness (W1, W2, W3, W4)
Opportunities (O1, O2, O3, O4)	SO1: Development of the production of palm oil through ownership infrastructure. SO2: Production of palm oil through the development and creation of a network of partners. SO3: Organization of palm oil branding, especially for the organisation's products and major markets. SO4: Development of social interactions with relevant institutions.	WO1: Cost Management and Efficiency Improvement WO2: Sustainable Resource Management and Development WO3: Process Optimization and Operational Excellence WO4: Stakeholder Engagement and Community Development
Threats (T1, T2, T3, T4)	ST1: Cost Leadership Strategy ST2: Product Differentiation Strategy ST3: Market Segmentation Strategy ST4: Innovation and Research Strategy	WT1: Risk Management and Contingency Planning WT2: Diversification and Market Expansion WT3: Quality Assurance and Compliance WT4: Regulatory Compliance and Standard Adherence

SO1: Development of the production of palm oil through ownership infrastructure:

From Table 4, this strategy involves investing in and owning the infrastructure required for palm oil production. It may include acquiring and managing palm oil plantations, mills, and processing facilities. By having ownership and control over the production infrastructure, companies can ensure efficient operations, quality control, and cost optimization.

SO2: Production of palm oil through the development and creation of a network of partners:

This strategy focuses on forming partnerships and collaborations with various stakeholders involved in the palm oil supply chain. This can include partnering with smallholder farmers, local communities, research institutions, and industry organisations. By leveraging these partnerships, companies can expand their production capabilities, access a wider network of suppliers, and enhance overall efficiency.

SO3: Organization of palm oil branding, especially for the organisation's products and major markets:

This strategy emphasises branding and marketing efforts for palm oil products, with a focus on capturing major markets. It involves developing a strong brand identity, promoting sustainable and responsible practices, and highlighting the quality and traceability of Malaysian palm oil. Effective branding can help differentiate Malaysian palm oil from competitors, enhance market presence, and build consumer trust.

SO4: Development of social interactions with relevant institutions:

This strategy involves actively engaging with relevant institutions, both domestically and internationally, to strengthen the palm oil industry's position and address concerns. This includes establishing partnerships with government bodies, NGOs, consumer advocacy groups, and sustainability initiatives. By fostering positive relationships and collaboration, the industry can contribute to policy development, promote sustainable practices, and address social and environmental challenges.

ST1: Cost Leadership Strategy

Implementing a cost leadership strategy involves focusing on cost efficiency throughout the palm oil supply chain. This can be achieved by optimising production processes, leveraging economies of scale, adopting technology advancements, and streamlining operations. By minimising costs, companies can offer competitive pricing and potentially gain market share.

ST2: Product Differentiation Strategy

A product differentiation strategy involves developing unique features, qualities, or branding for palm oil products. This can include promoting sustainable and eco-friendly practices, ensuring traceability, and emphasising high-quality standards. By differentiating their palm oil products, companies can attract customers who value sustainability, health, and ethical considerations.

ST3: Market Segmentation Strategy

Market segmentation involves identifying specific target markets or customer segments within the palm oil industry. This strategy focuses on tailoring products, marketing, and distribution approaches to meet the unique needs and preferences of different customer groups. By understanding and catering to specific market segments, companies can gain a competitive advantage and better address customer demands.

ST4: Innovation and Research Strategy

An innovation and research strategy involves investing in research and development (R&D) activities to drive

product and process innovation in the palm oil supply chain. This can include developing new palm oil derivatives, exploring sustainable cultivation practices, and improving processing technologies. By continuously innovating, companies can stay ahead of competitors, meet evolving market trends, and create value-added offerings.

WO1: Cost Management and Efficiency Improvement

This strategy focuses on managing costs throughout the palm oil supply chain. It involves implementing cost control measures, optimising resource allocation, and seeking cost-saving opportunities. By efficiently managing expenses, companies can improve profitability and maintain competitiveness in the market.

WO2: Sustainable Resource Management and Development

The WO2 strategy centres around responsible resource management. This includes implementing sustainable cultivation practices, minimising environmental impact, and ensuring the long-term viability of palm oil production. By prioritising sustainability, companies can meet consumer expectations, comply with regulatory requirements, and safeguard the reputation of the industry.

WO3: Process Optimization and Operational Excellence

The WO3 strategy emphasises improving operational processes and enhancing overall efficiency. This can involve analysing and streamlining workflows, implementing lean principles, and adopting technology to automate manual tasks. By optimising processes, companies can reduce waste, improve productivity, and enhance customer satisfaction.

WO4: Stakeholder Engagement and Community Development

The WO4 strategy focuses on building positive relationships with stakeholders and contributing to community development. This can include engaging with local communities, supporting education and healthcare initiatives, and promoting fair trade practices. By actively involving stakeholders and fostering social responsibility, companies can enhance their reputation, build trust, and create a sustainable business environment.

WT1: Risk Management and Contingency Planning

This strategy focuses on identifying and mitigating potential risks within the palm oil supply chain. It involves conducting risk assessments, implementing risk management processes, and developing contingency plans to address unforeseen events such as natural disasters, market fluctuations, or regulatory changes. By proactively

managing risks, companies can minimise disruptions and protect their operations.

WT2: Diversification and Market Expansion

The WT2 strategy involves diversifying product offerings and expanding into new markets. This can include developing value-added palm oil derivatives, exploring niche markets, or targeting new geographical regions. By diversifying and expanding market reach, companies can reduce reliance on a single market segment and capture new growth opportunities.

WT3: Quality Assurance and Compliance

This strategy emphasises maintaining high product quality and adhering to regulatory standards. It involves implementing quality assurance programs, ensuring product traceability, and complying with food safety and sustainability certifications. By prioritising quality and compliance, companies can build trust with customers, meet market requirements, and avoid reputational damage. To prioritise strategies based on the QSPM, Table 5 is presented. This table indicates the QSPM for Offensive Strategies (SO), Competitive Strategies (ST), Conservative Strategies (WO) and Defensive Strategies (WT).

Table 5: QSPM for (a) offensive Strategies, (b) Competitive Strategies, (c) Conservative Strategies, (d) Defensive Strategies
a) Offensive Strategies

Strength	Weight	S0 1		S0 2		S0 3		S0 4	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS
S1	0.213	3.5	0.746	3	0.639	1.25	0.266	3	0.639
S2	0.131	4.0	0.524	3.5	0.459	3.5	0.459	3.25	0.426
S3	0.051	2.8	0.143	2.5	0.128	4	0.204	3	0.153
S4	0.105	3.0	0.315	3.5	0.368	4	0.420	4	0.420
W1	0.118	2.2	0.260	1.75	0.207	1.5	0.177	2.25	0.266
W2	0.123	1.5	0.185	3	0.369	2.5	0.308	2.75	0.338
W3	0.152	1.0	0.152	1.5	0.228	2	0.304	2	0.304
W4	0.107	1.7	0.182	2.75	0.294	3.5	0.375	3.75	0.401
O1	0.194	2.9	0.563	2	0.388	3	0.582	3.5	0.679
O2	0.102	3.1	0.316	1.25	0.128	1.75	0.179	1.5	0.153
O3	0.134	3.9	0.523	1.5	0.201	2	0.268	2	0.268
O4	0.070	3.0	0.210	2.5	0.175	3.5	0.245	2.75	0.193
T1	0.205	1.0	0.205	2.75	0.564	1.5	0.308	3.5	0.718
T2	0.059	1.7	0.100	2	0.118	2.75	0.162	4	0.236
T3	0.179	2.1	0.376	2.5	0.448	3	0.537	3.5	0.627
T4	0.057	1.4	0.080	2.5	0.143	3	0.171	1	0.057
SUM			4.880		4.854		4.963		5.876

b) Competitive Strategies

Strength	Weight	ST1		ST 2		ST 3		ST 4	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS
S1	0.213	3.5	0.746	3.5	0.746	4	0.852	1	0.213
S2	0.131	1.5	0.197	4	0.524	1.5	0.197	2.25	0.295
S3	0.051	1.25	0.064	4	0.204	2.25	0.115	3.5	0.179
S4	0.105	2.25	0.236	3.25	0.341	3.5	0.368	3	0.315
W1	0.118	3	0.354	2.75	0.325	3.75	0.443	1.5	0.177
W2	0.123	2	0.246	3	0.369	3	0.369	3.5	0.431
W3	0.152	1	0.152	3	0.456	2.75	0.418	3.75	0.570
W4	0.107	1.75	0.187	3.5	0.375	3	0.321	2.5	0.268
O1	0.194	3	0.582	3.75	0.728	4	0.776	3.5	0.679
O2	0.102	1.25	0.128	2	0.204	2.25	0.230	2.75	0.281
O3	0.134	2	0.268	2.75	0.369	2.5	0.335	2.5	0.335
O4	0.070	2	0.140	2.5	0.175	3	0.210	3.5	0.245
T1	0.205	4	0.820	3.25	0.666	4	0.820	3	0.615
T2	0.059	3.5	0.207	3.5	0.207	3.75	0.221	2.25	0.133

Strength	Weight	ST1		ST 2		ST 3		ST 4	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS
T3	0.179	3	0.537	3.5	0.627	3	0.537	2	0.358
T4	0.057	3.75	0.214	3	0.171	1.5	0.086	2.5	0.143
SUM			5.076		6.484		6.296		5.234

c) Conservative Strategies

Strength	Weight	WO1		WO 2		WO 3		WO 4	
		AS	TAS	AS	TAS	AS	TAS	AS	TAS
S1	0.213	2.5	0.533	1.75	0.373	1.5	0.320	3.25	0.692
S2	0.131	2.75	0.360	2.5	0.328	2.25	0.295	2.5	0.328
S3	0.051	3	0.153	1.5	0.077	1.75	0.089	3.5	0.179
S4	0.105	3.5	0.368	1.25	0.131	2.5	0.263	2.25	0.236
W1	0.118	3.25	0.384	2	0.236	3	0.354	3.5	0.413
W2	0.123	3	0.369	2.5	0.308	3.5	0.431	3	0.369
W3	0.152	2.5	0.380	4	0.608	2.5	0.380	2.5	0.380
W4	0.107	3.25	0.348	3	0.321	4	0.428	4	0.428
O1	0.194	4	0.776	1.5	0.291	1.75	0.340	3.5	0.679
O2	0.102	2	0.204	3	0.306	2.75	0.281	3.75	0.383
O3	0.134	1.5	0.201	2.75	0.369	3.5	0.469	3.25	0.436
O4	0.070	1.5	0.105	2.75	0.193	3	0.210	3.5	0.245
T1	0.205	2.75	0.564	1.5	0.308	3	0.615	2.25	0.461
T2	0.059	3.5	0.207	1.25	0.074	3.75	0.221	2	0.118
T3	0.179	3.75	0.671	2	0.358	3.5	0.627	3.5	0.627
T4	0.057	1.5	0.086	1	0.057	3.25	0.185	3.5	0.200
SUM			5.707		4.335		5.506		6.172

d) Defensive Strategies

Strength	Weight	WT1		WT 2		WT 3	
		AS	TAS	AS	TAS	AS	TAS
S1	0.213	1	0.213	2.75	0.586	2	0.426
S2	0.131	2	0.262	1.5	0.197	1.5	0.197
S3	0.051	1.75	0.089	2	0.102	1	0.051
S4	0.105	1.5	0.158	2.25	0.236	1.25	0.131
W1	0.118	4	0.472	3.5	0.413	3.5	0.413
W2	0.123	3.75	0.461	3	0.369	3	0.369
W3	0.152	3.5	0.532	4	0.608	3.75	0.570
W4	0.107	4	0.428	3.25	0.348	3.25	0.348
O1	0.194	1	0.194	1.5	0.291	1.5	0.291
O2	0.102	1.25	0.128	2.75	0.281	1	0.102
O3	0.134	2	0.268	3	0.402	1.75	0.235
O4	0.070	1.5	0.105	1.5	0.105	1.25	0.088
T1	0.205	3.5	0.718	2.75	0.564	3.5	0.718
T2	0.059	3.25	0.192	2	0.118	2.5	0.148
T3	0.179	2.75	0.492	3.75	0.671	3.75	0.671
T4	0.057	3	0.171	3	0.171	2.5	0.143
SUM			4.882		5.461		4.898

Based on Table 5, the presented data appears to be a QSPM (Quantitative Strategic Planning Matrix) examination of Malaysia's palm oil supply chain. The QSPM is a strategic management technique for assessing

and prioritising various strategies based on their feasibility, attractiveness, and possible influence on the organisation or sector.

There are four areas in the analysis: aggressive tactics, competitive strategies, conservative strategies, and defensive strategies. Each part is comprised of a matrix including numerous techniques and their accompanying weights, strengths, and total attractiveness ratings (TAS). The TAS is computed by multiplying each strategy's strength by its weight and adding the results.

The section on offensive strategies focuses on techniques for aggressively pursuing expansion and gaining a competitive advantage in the palm oil supply chain. The offensive strategy with the greatest total attractiveness score (TAS) in this section is Strategy S4, which has the most potential effect and feasibility among the offensive strategies. The section on competitive tactics examines ways for gaining a competitive advantage over other competitors in the palm oil sector. The TAS of Strategy ST2 is 6.484, making it the most appealing and realistic competitive strategy in this examination. Conservative strategies are those that prioritise stability, risk minimization, and sustaining the status quo. Strategy WO4 has the greatest TAS of 6.172 among the conservative options, showing its potential effect and practicality. The section on defensive tactics focuses on techniques for mitigating possible risks, hazards, or interruptions in the palm oil supply chain. WT3 has the greatest TAS of 5.461, indicating its desirability and practicality as a defensive approach.

Overall, the QSPM research provides a thorough review of various techniques in Malaysia's palm oil supply chain. The plans with the highest TAS ratings in each component have the greatest potential effect and feasibility. Decision-makers may use these ratings to prioritise and pick appropriate tactics depending on the organization's or industry's particular objectives and limits.

Table 6: Priorities Strategies Based on QSPM Result

Strategies	Attractiveness Score (SUM)	Priority
SO1	4.880	13
SO2	4.854	14
SO3	4.963	10
SO4	5.876	4
ST1	5.076	9
ST2	6.484	1
ST3	6.296	2
ST4	5.234	8
WO1	5.707	5
WO2	4.335	15
WO3	5.506	6
WO4	6.172	3
WT1	4.882	12
WT2	5.461	7
WT3	4.898	11

Table 6 summarises the weight of each of the strategies prioritised. The findings indicate that the top goal is to activate the current infrastructure to its maximum potential. When a corporation is following conservative supply chain policies for palm oil in Malaysia, this tactic is employed. The strategy with the highest attractiveness score is the product differentiation strategy (ST2), with an attractiveness value of 6.484. This makes it the most appealing strategy out of those listed, and it also highlights how important it is strategically and how important it is for the palm oil business to differentiate its goods. The most consideration and consideration for immediate implementation should be given to this priority. With an attractiveness score of 4.335, Sustainable resource management and development (WO2), the least appealing of the mentioned strategies, has the lowest attractiveness score. It has been given the 15th-lowest priority, indicating that it should be treated with the least care or even ignored.

5. Conclusions

In conclusion, the palm oil supply chain in Malaysia is intricate and vital to the economy. Malaysia produces and exports a substantial amount of palm oil. Participants in the Malaysian palm oil supply chain include smallholders, plantations, mills, refineries, and exporters. The production of palm oil is significantly influenced by smallholders. Smallholders struggle with resource scarcity, low productivity, and issues of sustainability. Malaysian palm oil production relies on large-scale plantations. Plantations owned by corporations employ mechanisation and effective land management. Some Malaysian palm oil plantations are charged with deforestation, biodiversity loss, and violations of human rights. The modern palm oil milling industry in Malaysia efficiently extracts and refines palm oil from fresh fruit clusters. Food safety and quality are guaranteed by stringent regulations. However, improvements must be made to milling waste management and greenhouse gas emissions. Malaysia has addressed sustainability issues in the palm oil supply chain.

The Roundtable on Sustainable Palm Oil (RSPO) has certified the country's sustainable practices. Improving smallholder livelihoods, palm oil's environmental impact, and its traceability. However, the palm oil supply chain in Malaysia remains unsustainable. It is difficult to strike a balance between economic progress, environmental conservation, and social responsibility. To address these issues and promote sustainable palm oil production in Malaysia, government, business, NGOs, and consumers must collaborate. The supply chain for Malaysian palm oil is essential for sustainability, environmental preservation, and social responsibility. Malaysia's palm oil industry can

be improved by implementing sustainable practices, addressing deforestation and human rights, and enhancing transparency and traceability.

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References

- Amindoust, A., Ahmed, S., & Saghafinia, A. (2012). Supplier performance measurement of palm oil industries from a sustainable point of view in Malaysia. *BioTechnology: An Indian Journal*, 6(6), 155-158.
- Arshad, F., Subramaniam, V., Nambiappan, B., Ismail, A., & Yusoff, S. (2019). Energy consumption during transportation along the palm oil supply chain in Malaysia. *Journal of Oil Palm Research*, 31(4), 641-650.
- Basiron, Y. (2008). The Palm Oil Industry in Malaysia: From Seed to Frying Pan. *Journal of Oil Palm Research*, 20(3), 5-10.
- Basiron, Y. (2017). Palm Oil Production through Sustainable Plantations. OCL - Oilseeds and Fats, *Crops and Lipids*, 24(1), 102.
- Gottwald, E. (2018). Certifying exploitation: why “sustainable” palm oil production is failing workers. *In New Labor Forum*, 27(2), 74-82.
- Guan, C. C., Ameer, S., Arrifin, S., & McKay, A. (2016). Environmental sustainability drivers: a study on Malaysian palm oil industry. *IAFOR Journal of Sustainability, Energy & the Environment*, 3(1), 5-7.
- Ibragimov, A., Sidique, S.F. & Tey, Y.S. (2019). Productivity for sustainable growth in Malaysian oil palm production: a system dynamics modelling approach. *Journal of Cleaner Production*, 21(3), 10 - 11.
- Lim, C.I., & Biswas, W. (2019). Sustainability assessment for crude palm oil production in Malaysia using the palm oil sustainability assessment framework. *Sustainable Development*, 27(3), 253 -269.
- Lim, J. S. (2017). Sustainable Palm Oil and Greenhouse Gas Emissions: A Comparative Life Cycle Assessment of Palm Oil Mills in Malaysia. *Journal of Cleaner Production*, 140(4), 12-15.
- Lyons-White, J., & Knight, A. T. (2018). Palm oil supply chain complexity impedes implementation of corporate no-deforestation commitments. *Global Environmental Change*, 50, 303-313.
- Mat, S. B. (2012). The Palm Oil Industry From The Perspective of Sustainable: A Case Study of Malaysian Palm Oil Industry. Graduate School of Asia Pacific Studies, *Ritsumeikan Asia Pacific University of Japan*, 7(1), 95 -97.
- Mukherjee, A., Kamarulzaman, N. H., Shamsudin, M. N., & Latif, I. A. (2015). Agility barriers analysis in the Malaysian Palm Oil industry. *International Journal of Supply Chain Management*, 4(1), 60-64.
- Nagiah, C., & Azmi, R. (2013). A review of smallholder oil palm production: challenges and opportunities for enhancing sustainability-a Malaysian perspective. *Journal of Oil Palm, Environment and Health (JOPEH)*, 3(1), 20 -23.
- Naidu, L., & Ravichandran, M. (2021). A Review of Key Sustainability Issues in Malaysian Palm. *Journal of Sustainability*, 13(19), 3 - 10.
- Razali, A. M., & Fah, B. C. Y. (2019). The Role of Infrastructure Development and Logistics Management in the Malaysian Palm Oil Industry. *International Journal of Supply Chain Management (IJSCM)*, 8(5), 495-502.
- Saha, A., Debnath, B. K., Chatterjee, P., Panaiyappan, A. K., Das, S., & Anusha, G. (2024). Generalized Dombi-based probabilistic hesitant fuzzy consensus reaching model for supplier selection under healthcare supply chain framework. *Engineering Applications of Artificial Intelligence*, 133, 107966. <https://doi.org/10.1016/j.engappai.2024.107966>
- Shahbaz, M. S., RM, R. Z., Bin, M. F., & Rehman, F. (2017). What is supply chain risk management? A review. *Advanced Science Letters*, 23(9), 9233-9238.
- Teng, S., Kok, W. K., & Norbani, C. H. (2020). Palm oil and its environmental impacts: A big data analytics study. *Journal of Cleaner Production*, 274(9), 7- 8.
- Uthayakumar, A., & Thong, T. P. (2017). Labor Rights Violations in the Palm Oil Sector in Malaysia: A Perspective of Plantation Workers. *Journal of Economics and Sustainable Development*, 8(3), 59-66.
- Vijayakumaran, S. A., Abdul Rahim, S., Ahmi, A., Abdul Rahman, N. A., & Mazlan, A. U. (2020). Factors influencing sustainable supplier selection: Evidence from palm oil refining and oleochemical manufacturing industry. *International Journal of Supply Chain Management (IJSCM)*, 9(1), 437-446.
- Yahya, H., Prabakusuma, A., Hussain, M., Patwary, A., Dedahujiev, A., & Aleryani, R. (2022). Sustainability and profitability of Malaysia crude palm oil supply chain management: system dynamics modelling approach. *Malaysia crude palm oil supply chain management*, 9(1), 20 - 25.

Appendixes

APPENDIX A

The main strengths of the company are as follows:

STRENGTHS

1. **Abundant and productive plantations:** Malaysia has a lot of territory ideal for growing palm oil and a good climate, which makes for abundant and productive plantations. It has high yields per hectare when compared to other oilseed crops, making it one among the world's major producers and exporters of palm oil. (Natalie Kindred, 2018).
2. **Infrastructure in place:** Malaysia has a well-established infrastructure for the production of palm oil, including effective transportation systems, processing facilities,

and refineries. This infrastructure makes it possible to produce and distribute palm oil products in a timely and economical manner (Razali & Fah, 2019).

3. Global Market Dominance: Due to its excellent quality, reasonable cost, and adaptability in a variety of uses, Malaysian palm oil is well known and highly sought after in foreign markets. It has a substantial market share worldwide, especially in places like India, China, and Europe (Basiron, 2017).
4. Economic contribution: Palm oil farming contributes to the diversification of economies that rely largely on a few commodities. Countries may lessen their reliance on a small number of export items by planting and processing palm oil, making their economy more robust to price changes and market uncertainty (Umayah, 2021).

APPENDIX B

The main weaknesses of the company are as follows:

WEAKNESS

1. Environmental Issues: Due to deforestation, habitat devastation, and greenhouse gas emissions brought on by land conversion, palm oil production has come under fire (Naidu & Ravichandran, 2021). Although conservation initiatives and sustainable practices like certified plantations are being carried out, there is still a need to adequately address environmental problems (Naidu & Ravichandran, 2021). Due to charges that palm oil products are the consequence of imported deforestation, these negative effects on ecosystems and natural resources have adversely affected the palm oil sector.
2. Dependence on export markets: makes it susceptible to changes in the world economy and political climate. Malaysia sells a lot of its palm oil on foreign markets. Demand for and pricing of Malaysian palm oil can be affected by changes in trade regulations, import limitations, or altering consumer tastes (Mohammed Ebrahim Hussein, 2017).
3. Sustainability challenges: Land use disputes are common when palm oil plantations are constructed on areas historically owned or used by local groups, especially indigenous peoples (Arshad et al., 2019). These disputes can emerge as a result of inadequate acknowledgement of land rights, a lack of effective consultation, and community dislocation. Respecting indigenous rights and resolving land tenure concerns are critical for long-term palm oil development (Naidu & Ravichandran, 2021).
4. Price volatility: Palm oil manufacturers frequently keep stockpiles on hand to control price swings and satisfy market demand. However, if prices fall, the value of current inventory may fall, potentially

resulting in losses. To limit the detrimental effects of price volatility on the company's financial performance, inventory levels and market circumstances must be balanced (Abdulrazik et al., 2017).

APPENDIX C

The main opportunities of the company are as follows:

OPPORTUNITIES

1. Growing Demand : Because palm oil is useful in the food, cosmetics, and biofuel industries, there is likely to be a rise in the demand for it globally. Malaysia has chances to increase its palm oil exports due to the growing populations, urbanization, and shifting dietary preferences in emerging markets (Khatiwada, 2021).
2. Value-Added Products : By creating and promoting value-added goods like specialty fats, biodiesel, and oleochemicals, Malaysia has the opportunity to diversify its reliance on palm oil. These goods have greater profit margins and address certain market demands, which raises the overall competitiveness of Malaysian palm oil (Shahbaz & Rehman, 2017)
3. Increasing use in biofuels: Biofuels, such as palm oil-based biodiesel, help to improve energy security by lowering reliance on imported fossil fuels. Countries with limited domestic oil sources or a heavy reliance on imports might profit from encouraging the use of biofuels derived from locally cultivated feedstocks such as palm oil. This increases energy independence while decreasing exposure to variations in oil prices and supply interruptions. (Hoffmann et al., 2017)
4. Technological advancement: Innovative technologies have the potential to improve quality control procedures throughout the palm oil manufacturing process. Automation and sensor technology may provide accurate monitoring of factors like temperature, moisture, and acidity, maintaining constant product quality and safety requirements. This boosts market acceptability and customer confidence. (David E. Bell, 2018)

APPENDIX D

The main threats of the company are as follows:

THREATS

1. Competitor Countries: Malaysia faces fierce competition from other nations that produce palm oil, such as Indonesia, Thailand, and Colombia. To compete with Malaysia's market share and pricing, they have increased their cultivation areas and made investments in infrastructure upgrades (Lyons & Knight, 2018). In 2006, Indonesia surpassed Malaysia as the world's largest producer of palm oil, and it is anticipated that the rivalry would get tougher as a

result of changes to Indonesia's export tax regime. In order to safeguard its own refining industry, Malaysia charges a hefty duty on the export of crude palm oil, while Indonesia cut its export tax on palm oil products by more than half in October 2011 (Mat, 2012).

2. Negative Public Perception: Consumers, NGOs, and regulatory agencies all have a poor opinion of palm oil's effect on the environment, which is a threat to the sector. The export of Malaysian palm oil may be hampered by increased monitoring, labeling specifications, and potential boycotts (Teng, Kok, & Norbani, 2020). NGOs blame palm oil's impact on biodiversity loss and rainforest deforestation on greed, corruption, and profit, all of which contribute to a global environmental crisis. It argues that using palm oil increases global warming and deforestation (Gottwald, 2018). This causes people to assume a lot of negative perception that any restriction will also be imposed to protect the environment that gives effect on the company.
3. Consumer preferences and awareness: Shifts in demand or the creation of substitute vegetable oils may

result from shifting consumer preferences and rising awareness of sustainable sourcing, deforestation, and environmental concerns (Nagiah & Azmi, 2013). Due to changing consumer lifestyles and rising concerns about consumer health, food safety, and the environment, the future of food-based agriculture crops like palm oil is becoming more challenging. For instance, the EU and the USA have unfairly imposed limitations on the importation of palm oil due to concerns. The proposed imposition of stringent certification for sustainability on investment in oil palm cultivation by the World Bank would reduce the expansion and development of the palm oil sector (Mat, 2012).

Land availability and conflicts: There is a scarcity of adequate land for palm oil growth. As demand for palm oil grows, particularly in emerging nations, so does competition for land resources. This paucity of accessible land may limit palm oil manufacturers' development options and may lead to increased land costs, making it more difficult to construct new plantations (Dela Febriana, 2022).