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Unlocking Strategic Renewal Supply Chain Options for the Malaysian Automotives Sector

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Abstract: *The automotive sector in Malaysia has encountered a multitude of challenges, ranging from shifting consumer sentiments to stringent regulatory frameworks and limited market access. These obstacles have significantly impeded the sector's sustainability, resilience, and growth potential. To address these pressing issues, this study presents a roadmap for the Malaysian automotive sector, by utilising the SWOT-QSPM to evaluate various strategic options along the automotive supply chain. The analysis highlights several key findings in the automotive sector. Notably, the industry benefits from a well-established supply chain network, while opportunities lie in the growing demand for electric and hybrid vehicles. However, stringent emissions regulations and evolving consumer preferences present significant challenges to traditional manufacturing practices. To navigate these challenges and capitalise on opportunities, embracing diversity and adopting competitive strategies are crucial. Moreover, prioritising technological advancements to enhance production efficiency emerges as a key strategy for success in the evolving automotive landscape.*

Keywords: Automotive supply chain; SWOT-QSPM technique; Strategic planning; Sustainability; Malaysia
JEL Classification: J60, J71, J81

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1. Introduction

Malaysia has a long history in the production of motor vehicles. In 1960, the Malaysian government promoted the establishment of car assembly plants to reduce imported fully assembled vehicles, boost the economy, create jobs, and facilitate technology transfer. Subsequently, in the 1970s, the Local Content Policy was introduced to encourage the growth of local parts and components sector (MAA, 2023). Now, Malaysia's automotive sector, with 27 vehicle producers and over 640 component manufacturers (MIDA, 2021), has an established cluster with local and foreign manufacturers and assemblers. Proton and Perodua, the two local car producers, contributed more than 60% of the total automotive market share in 2023 (Tan, 2024) and have strong technology partnerships with Geely and Daihatsu respectively. The Malaysian automotive sector, characterised by the predominance of passenger cars, is ranked as Southeast Asia's third largest (after Thailand and Indonesia), and the world's 23rd largest, producing over 740,000 vehicles annually (Asian Insiders, 2024).

Though the automotive sector in Malaysia is highly regulated with the continued use of approved permits (APs) or import licences and duties to support the local industry (Aman, 2023), it is considered a high impact sector as it draws direct investments from global automakers, and contributes significantly to employment (Tham, 2021), innovation (Akmal et al., 2016; Sundram et al., 2016; Syammaruthadevi et al., 2023), and economic growth. Despite that, the sector's landscape is rapidly evolving, driven by technological advancements, changing consumer behaviour, heightened environmental concerns, rising market uncertainty and competition. These challenges have underscored the need for strategic adaptation and proactive measures to ensure the sector's sustainability, resilience, and competitiveness (Akmal et al., 2016; Al Doghan & Sundram, 2023; Aljoghaiman & Sundram, 2023; Vatumalae et al., 2022, 2023).

By offering a strategic roadmap grounded in in-depth qualitative analysis and sectoral insights, this study aims to guide policymakers, industry leaders, and stakeholders in navigating the complexities of the automotive landscape, addressing how the Malaysian automotive sector can strategically adapt to emerging trends such as the growing demand for electric and hybrid vehicles, while mitigating threats posed by stringent emissions regulations and market disruptions, to sustain its competitiveness and foster innovation

(Loang, 2023). The study concludes with recommendations to unlock the sector's full potential.

2. Literature Review

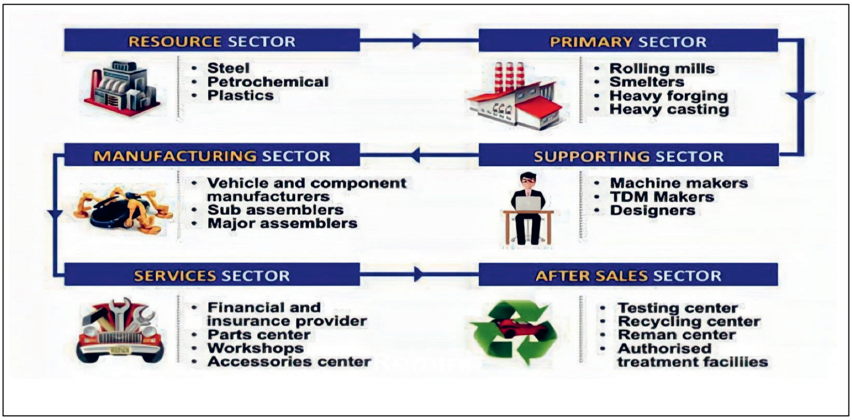
The related underpinning theories for this study such as Porter's five forces, resource-based view (RBV), disruptive innovation theory and technology adoption theory offer valuable insights for analysing the Malaysian automotive sector. Porter's model elucidates industry competitiveness, while RBV emphasises leveraging internal resources for advantage (Atika et al., 2024; Porter, 2008; Barney, 1991). Disruptive innovation theory guides responses to market shifts, particularly toward electric vehicles (EVs), and technology adoption theory informs strategies for consumer acceptance (Christensen, 1997; Rogers, 2003). All the above theories underscore the importance of efficient coordination across the automotive supply chain (Chopra & Meindl, 2007). Integrated, these theories provide a robust framework for understanding and navigating the complexities of Malaysia's automotive landscape, informing strategic decisions and fostering industry resilience and innovation. The Malaysian automotive industry has undergone significant transformations since its inception in the 1980s. Initially driven by national car projects such as Proton and Perodua, Malaysia has evolved from being a mere motor car assembler to a full-fledged car manufacturer (MIDA, 2021a). Despite its strengths, the Malaysian automotive sector faces several challenges. Firstly, it heavily relies on traditional manufacturing methods and internal combustion engine vehicles. However, global trends are shifting toward electric and hybrid vehicles, posing a challenge for the industry. To remain competitive, the sector must accelerate its transition to cleaner technologies and explore alternative powertrains (Akmal et al., 2016). Secondly, regulatory hurdles, such as APs and import duties, have been criticised for impeding competitiveness and innovation. Streamlining regulations and fostering a more conducive business environment are essential for sustained growth. Lastly, meeting stricter emissions regulations while maintaining affordability remains a delicate task (Asian Insiders, 2024; Aman, 2023).

On the other hand, the sector also presents exciting opportunities. The global demand for electric and hybrid vehicles offers Malaysian manufacturers a significant market to tap into. Diversifying product offerings to include eco-friendly options can position them well in this growing segment (Yaakub & Daud 2018; Razman & Ramayah, 2020). Investments in research and development for electric drivetrains and battery technology are crucial. Strategic alliances with foreign technology partners allow Malaysian companies to access cutting-edge expertise and accelerate innovation. Joint ventures and technology transfers enhance the sector's competitiveness (Noor et al., 2021; Razman & Ramayah, 2020). Additionally, embracing sustainable manufacturing practices (SMPs) is vital. SMPs encompass areas such as supply chain management, social responsibility, and environmental management. Leveraging Industry 4.0 technologies, including digitisation and automation, can further enhance efficiency and competitiveness (Yaakub & Daud, 2018). While challenges persist, the Malaysian automotive sector has ample opportunities for growth and innovation. By embracing technological advancements, fostering strategic partnerships, and prioritising sustainability, the industry can position itself for long-term success in the global market (MIDA, 2021b).

3. Automotive Supply Chain in Malaysia

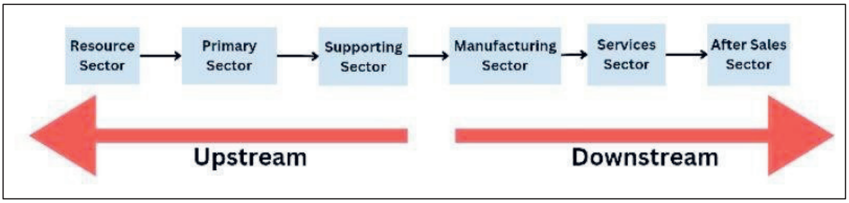
The automotive supply chain begins with the resource sector, which involves the extraction, processing, and utilisation of natural resources (see Figures 1 and 2). In the automotive sector, the raw materials required include metals, minerals, petroleum, petrochemicals, rubber, and energy. These raw materials are then transported to the primary sector for further processing into various components required for automotive manufacturing, such as engines, transmissions, electronics, chassis, and interior parts. The transformation processes—rolling mills, smelters, heavy forging, and heavy casting—are integral parts of the primary sector.

Figure 1: Automotive Supply Chain in Malaysia



Source: Malaysia Investment Development Authority (MIDA).

Figure 2: Automotive Supply Chain



The supporting sector of the automotive industry encompasses various entities that provide specialised services and expertise, including machine makers, tool, die, and mould (TDM) makers, and designers. These entities play crucial roles in producing automotive components by supplying automation systems, robotics, machines, and technologies such as computer-aided design (CAD) and computer-aided manufacturing (CAM). Once components are ready, they move to the manufacturing sector, where vehicle manufacturers like Proton and Perodua oversee the production of complete vehicles. Sub-assemblers focus on specific assemblies or systems, such as braking or suspension systems, while major assemblers handle the final assembly of vehicles (Habisch et al., 2022). Parts centres ensure the availability of genuine automotive parts for manufacturers, dealerships, and vehicle owners. Workshops provide maintenance, repair, and servicing services to keep vehicles in optimal condition, while accessories centres cater to customisation demands by offering aftermarket accessories and personalisation options. These entities collaborate with stakeholders to form a comprehensive support system for the automotive sector. At the end of the supply chain, after-sales services focus on vehicle maintenance, sustainability, and responsible practices (Habisch et al., 2022).

4. Methodology

The methodology of the study involves assessing Malaysia's automotive supply chain management (ASCM) industry through a SWOT analysis and developing effective strategies for progress. Data collection methods include an extensive review of past literature and field observation across the automotive supply chain. The literature gathered covers various sources related to the paper's keywords. SWOT analysis is employed to measure the organisation's strengths and weaknesses, as well as the externally encountered opportunities and threats (Lohrke et al., 2022). This approach is suitable for understanding the ASCM environment in Malaysia and developing strategies to enhance the sector's welfare by leveraging strengths and opportunities.

The SWOT-QSPM (quantitative strategic planning matrix) methodology involves several steps. First, a comprehensive analysis of the automotive sector's internal strengths and weaknesses, as well as external opportunities and threats, is conducted using the SWOT framework. Next, strategic options are identified based on the SWOT analysis. These options are then evaluated using the QSPM, which assigns weights to the factors identified in the SWOT analysis and scores each strategic option based on its potential impact on achieving strategic objectives. Finally, the strategic options are prioritised based on their total attractiveness scores, guiding decision-makers in selecting the most viable strategies for the automotive sector.

The SWOT-QSPM methodology offers several advantages over other strategic planning methods. It allows for a comprehensive analysis of both internal and external by integrating SWOT analysis with the QSPM, the method considers a wide range of factors, including strengths, weaknesses, opportunities, and threats, providing a holistic view of the strategic landscape. Unlike traditional SWOT analysis, which primarily involves qualitative assessments, the QSPM introduces a quantitative aspect to the evaluation process. This quantitative approach enables decision-makers to assign weights to different factors and score strategic options based on their potential impact, facilitating more objective decision-making.

Overall, the SWOT-QSPM methodology offers a robust framework for strategic planning, combining qualitative and quantitative analyses to inform decision-making and drive organisational success.

5. Qualitative Findings

5.1 Identifying and defining internal and external factors

At the company level, the strengths, and weaknesses (internal factors), and opportunities and threats (external factors) are identified and the sub-criteria for each of the four categories is reported in Table 1. The details of the sub-criteria of the four categories are described in Appendices A to D.

Table 1: Internal and External Factors of Influence for Automotives

Internal factors			
Weakness		**Strengths**	
W1	Dependence on imported components and parts for its automotive sector	S1	Proximity to major markets that offer a big consumer base
W2	Limited local supplier base, potentially impacting supply chain efficiency	S2	Established automotive ecosystem to stimulate the country's economy, ecology, and society
W3	Lack of innovation in the automotive sector affecting long-term growth prospects	S3	Active support from the Malaysian government towards the automotive sector
W4	Weak brand image making it difficult for Malaysian brands to compete in export markets	S4	High domestic demand is growing, and its middle class is expanding, fuelling demand for new automobiles
W5	Limited research and development capabilities	S5	Skilled automotive workforce that benefits from a trained labour base and supports expansion and competitiveness
External factors			
Threats		**Opportunities**	
T1	Global trade uncertainties due to changes in trade policies	O1	Increasing regional integration and free movement of goods, services, and skilled labour
T2	Changing regulations and compliance	O2	Growth in the ASEAN market to attract investments and foster sectoral growth

External factors			
Threats		Opportunities	
T3	Intense regional competition which has a strong automotive industry	O3	Adoption of advanced technologies (IoT, AI, and blockchain technology)
T4	Adapting to changing consumer preferences to remain competitive	O4	Expansion into new markets with strong manufacturing infrastructure and expertise
T5	Impact of economic downturns that affect the demand for new vehicles		

The prioritisation of the sub-criteria of strengths, weaknesses, opportunities, and threats of the company is presented in Table 2. Based on the prioritisation analysis of internal factors, the biggest strength (26.7%) of the automotive sector lies in establishing an automotive ecosystem to stimulate the country's economy, ecology, and society, and the most important weakness (29.1%) of the company is the limited local supplier base, potentially impacting supply chain efficiency. According to the experts interviewed, the small domestic market also explains another weakness which is the dependence of the sector on imported parts and components (27.5%). The results are not surprising as imports of parts and components have generally been trending upwards since the removal of import duties in 2024 (Anzawa, 2021) and supply chain disruptions plagued this sector during the pandemic.

Table 2: Prioritisation of Sub-Criteria of SWOT

Strengths (S)	Weight	Priority	Weaknesses (W)	Weight	Priority
S1	0.179	3	W1	0.275	2
S2	0.267	1	W2	0.291	1
S3	0.253	2	W3	0.150	3
S4	0.179	3	W4	0.134	4
S5	0.122	4	W5	0.150	3
Opportunities (O)	**Weight**	**Priority**	**Threats (T)**	**Weight**	**Priority**
O1	0.226	3	T1	0.229	2
O2	0.290	1	T2	0.200	3
O3	0.258	2	T3	0.171	4
O4	0.226	3	T4	0.143	5
			T5	0.257	1

From the external perspective, the biggest opportunity (29%) for the automotive sector is the growth in the Association of Southeast Asian Nations (ASEAN) market, while the biggest threat (25.7%) to the company is the impact of economic downturns on demand for new vehicles. Malaysia has the potential to serve as an EV hub and a hub for luxury cars for the region, which was valued at US$499 million in 2021, given its established supporting industries like semiconductors. For example, Volvo Car Malaysia, as part of its electrification plan and the first luxury car brand to locally assemble EVs in the country, has already made Malaysia its ASEAN hub.

5.2 Formulating company strategic options

The results of the analysis of the internal and external factors are presented in Table 3. There are four different strategies—defence strategy (WT), competitive strategy (ST), conservative strategy (WO), and offensive strategy (SO). The attractiveness score of the company's internal factors is 2.596. Since the desired score is higher than 2.5, it can be said that there is strength from the internal factors of the company. In other words, the strength of the company outweighs its weaknesses. In the case of the attractiveness score of external factors, it is marginally higher at 2.668, again implying that strengths overcome weaknesses and threats outweigh opportunities. Therefore, the company is in the (ST) area, where diversity and competitive strategies will have a higher priority.

Table 3: Analysis of Internal Factors and External Factors

Factors	Significance factor	Rank	Weighted score
	Internal factors		
	Strengths (S)		
S1	0.0895	2.9	0.2595
S2	0.1335	3.5	0.4672
S3	0.1265	3.4	0.4301
S4	0.0895	2.9	0.2595
S5	0.0610	2.6	0.1586
	Weaknesses (W)		
W1	0.1375	2.3	0.3162
W2	0.1455	2.4	0.3492
W3	0.0750	1.7	0.1275
W4	0.0670	1.5	0.1005
W5	0.0750	1.7	0.1275
SUM	1		2.5958

	External factors		
	Opportunities (O)		
O1	0.1004	3.2	0.3212
O2	1.2880	3.7	0.4765
O3	0.1146	3.5	0.4011
O4	0.1004	3.2	0.3212
	Threats (T)		
T1	0.1272	2.2	0.2798
T2	0.1111	2.1	0.2333
T3	0.0950	1.8	0.1710
T4	0.0794	1.5	0.1191
T5	0.1432	2.4	0.3436
SUM	1		2.6668

After examining the strengths and weaknesses as well as the opportunities and threats of the company, it is possible to formulate a strategy based on each factor. Table 4 present the SWOT for company strategies.

Table 4: Company Strategies

	Strengths (S1, S2, S3, S4, S5, S6, S7)		**Weakness (W1, W2, W3, W4, W5)**	
Opportunities (O1, O2, O3, O4)	*Offensive strategies (SO)*		*Conservative strategies (WO)*	
	SO1	Localisation of component manufacturing	WO1	Cost optimisation through efficient supply chain financing
	SO2	Collaboration with R&D institutions	WO2	Talent development and retention
	SO3	Development of sustainable and green practices	WO3	Streamlining and optimising operations and processes
	SO4	Collaboration with technology providers	WO4	Collaborative supplier relationships
Threats (T1, T2, T3, T4, T5)	*Competitive strategies (ST)*		*Defensive strategies (WT)*	
	ST1	Market expansion through international trade agreements	WT1	Cost reduction through efficient supply chain management
	ST2	Development of advanced manufacturing capabilities	WT2	Talent acquisition and development
	ST3	Innovation and product differentiation	WT3	Continuous improvement of quality management systems
	ST4	Collaboration in the electric vehicle (EV) ecosystem		

The following discussion interprets the underlying strategies of the SWOT in Table 4.

SO1. Localisation of component manufacturing: The sector can pursue the path of part localisation to reduce its dependency on imported components, which may involve encouraging local vendors to create or develop manufacturing facilities in Malaysia. By localising component manufacturing, the supply chain can benefit from shorter lead times, cheaper shipping costs, and more control over quality and production processes. Less reliance on overseas suppliers reduces risks connected with supply chain interruptions or volatility in global markets (Rajagopal et al., 2017).

SO2. Collaboration with research and development (R&D) institutions: Collaborations with academic/ research organisations can afford suppliers better access to knowledge, facilities, and resources, to develop cutting-edge products, techniques, and materials to drive innovation. These partnerships are important for making the transition to EVs, self-driving vehicles, and networked vehicles (Mohan et al., 2016).

SO3. Development of sustainable and green practices: Greening operations are important for businesses to improve efficiency, reduce carbon footprint, and gain better market access given the increased emphasis on sustainability. These include adopting environmentally friendly industrial techniques, utilising renewable energy, and implementing recycling and waste management activities.

SO4. Collaboration with technology providers: Strategic alliances with technology suppliers, such as software businesses, electronics manufacturers, and connectivity solution providers, are needed to improve digital and connectivity and to move ahead with telematics, and other sophisticated tools. This partnership has the potential to enable the incorporation of innovative technology into cars, improve consumer experience, and promote innovation.

ST1. Market expansion through international trade agreements: The sector should take advantage of international trade agreements to increase its global reach and to attract investments. For example, the tariff cuts under the Comprehensive and Progressive Transpacific Partnership (CPTPP) agreement are expected to attract more British cars to Malaysia (e.g., MINI, Land Rover).

ST2. Development of advanced manufacturing capabilities: The sector should concentrate on building sophisticated manufacturing capabilities to by implementing technology like automation, robotics, and digitalisation to boost mass customisation, and increase productivity, flexibility, speed of production, and quality.

ST3. Innovation and product differentiation: To differentiate itself in the market and a gain competitive edge in brand, the sector should prioritise product uniqueness in terms of distinctive features and design aspects for cars and components.

ST4. Collaboration in EV ecosystem: The sector needs to collaborate with EV manufacturers, and battery makers, and charging infrastructure suppliers to create a full EV value chain and transition away from internal combustion engine (ICE).

WO1. Cost optimisation through efficient supply chain financing: By exploring effective supply chain finance solutions, the sector can focus on cost optimisation—sourcing alternative or inexpensive funding and negotiating favourable terms with financial institutions.

WO2. Talent development and retention: To solve the skills gap and improve efficiency, the sector needs to engage in human resource development and retention. This involves offering staff training programmes, upskilling efforts, and job advancement possibilities.

WO3. Streamlining and optimising operations and processes: Businesses need to improve their processes by performing procedure audits, detecting bottlenecks, and implementing solutions to simplify operations.

WO4. Collaborative supplier relationships: Collaborative partnerships with suppliers are important to manage supply chain risks and improve supply chain transparency (Sundram et al., 2017).

WT1. Cost reduction through efficient supply chain management: Effective supply chain management practices, such as inventory control, transportation optimisation, and lean manufacturing techniques, are crucial for cost-cutting and for enhancing supply chain effectiveness (Sundram et al., 2018).

WT2. Talent acquisition and development: To ensure a competent workforce, there should be competitive hiring practices, followed by a lifelong learning culture within the business by emphasis upskilling through training programmes.

WT3. Continuous improvement of quality management systems: Businesses need to enhance their quality management systems to reduce defects and maintain their reputation through quality control procedures, audits, and compliance with international quality standards, like ISO 9001.

5.3 Evaluation of strategic alternatives

QSPM is a technique used to objectively evaluate strategic alternatives identified through the SWOT analysis. It helps in prioritising strategies by assigning weights to key factors, evaluating alternative strategies against these factors, and calculating total attractiveness scores for each strategy. The strategy with the highest total attractiveness score is considered the most feasible and suitable for implementation. Table 5 presents the SWOT-QSPM.

Table 5: QSPM for Automotives, by Types of Strategies

		Offensive strategies							
		SO1		**SO2**		**SO3**		**SO4**	
Key factors	**Weight**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.09	2.9	0.26	3.5	0.31	2.0	0.18	2.7	0.24
S2	0.13	3.5	0.47	3.3	0.44	3.0	0.40	3.1	0.41
S3	0.13	3.4	0.43	3.4	0.43	2.9	0.37	3.2	0.40
S4	0.09	2.9	0.26	2.3	0.21	1.2	0.11	2.8	0.25
S5	0.06	2.6	0.16	3.5	0.21	3.5	0.21	2.9	0.18
W1	0.14	2.3	0.32	2.2	0.30	3.4	0.47	2.6	0.36
W2	0.15	2.4	0.35	1.9	0.28	1.3	0.19	2.4	0.35
W3	0.08	1.7	0.13	3.0	0.23	3.5	0.26	3.2	0.24
W4	0.07	1.5	0.10	2.7	0.18	1.2	0.08	3.5	0.23
W5	0.08	1.7	0.13	1.5	0.11	3.6	0.27	3.7	0.28
O1	0.10	3.2	0.32	3.2	0.32	3.7	0.37	3.2	0.32
O2	0.13	3.7	0.48	3.4	0.44	3.4	0.44	2.7	0.35
O3	0.11	3.5	0.40	2.9	0.33	3.5	0.40	2.9	0.33
O4	0.10	3.2	0.32	3.7	0.37	3.2	0.32	2.8	0.28
T1	0.13	2.2	0.28	3.0	0.38	2.9	0.37	3.2	0.41
T2	0.11	2.1	0.23	2.7	0.30	2.8	0.31	3.4	0.38
T3	0.10	1.8	0.17	3.5	0.33	3.4	0.32	3.6	0.34
T4	0.08	1.5	0.12	3.1	0.25	3.7	0.29	3.6	0.29
T5	0.14	2.4	0.34	2.0	0.29	3.7	0.53	3.1	0.44
SUM			*5.26*		*5.71*		*5.90*		*6.09*

		Competitive strategies							
		ST1		**ST2**		**ST3**		**ST4**	
Key factors	**Weight**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.09	3.5	0.31	3.7	0.33	3.1	0.28	1.9	0.17
S2	0.13	3.3	0.44	3.4	0.45	3.5	0.47	3.2	0.43
S3	0.13	3.4	0.43	3.5	0.44	3.4	0.43	2.7	0.34
S4	0.09	2.3	0.21	3.2	0.29	3.2	0.29	2.3	0.21
S5	0.06	3.5	0.21	2.9	0.18	3.1	0.19	1.7	0.10
W1	0.14	2.2	0.30	2.8	0.39	3.7	0.51	1.6	0.22
W2	0.15	1.9	0.28	1.5	0.22	3.9	0.57	2.4	0.35
W3	0.08	2.7	0.20	1.7	0.13	2.1	0.16	3.1	0.23
W4	0.07	3.1	0.21	3.2	0.21	2.9	0.19	3.5	0.23
W5	0.08	3.2	0.24	3.7	0.28	2.8	0.21	3.4	0.26
O1	0.10	2.8	0.28	3.5	0.35	2.6	0.26	3.2	0.32
O2	0.13	2.9	0.37	3.2	0.41	3.1	0.40	3.1	0.40
O3	0.11	2.6	0.30	2.2	0.25	2.5	0.29	3.1	0.36
O4	0.10	2.4	0.24	2.1	0.21	2.1	0.21	3.7	0.37
T1	0.13	3.6	0.46	3.3	0.42	2.3	0.29	3.9	0.50
T2	0.11	3.7	0.41	3.4	0.38	1.9	0.21	2.1	0.23
T3	0.10	3.4	0.32	2.3	0.22	3.2	0.30	1.3	0.12
T4	0.08	3.5	0.28	3.5	0.28	2.7	0.21	2.4	0.19
T5	0.14	3.2	0.46	2.2	0.32	2.3	0.33	2.1	0.30
SUM			*5.95*		*5.75*		*5.80*		*5.33*

		Offensive strategies							
Key factors	**Weight**	**WO1**		**WO2**		**WO3**		**WO4**	
		AS	**TAS**	**AS**	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.09	2.9	0.26	3.4	0.30	3.2	0.29	3.6	0.32
S2	0.13	2.8	0.37	3.7	0.49	3.4	0.45	3.2	0.43
S3	0.13	2.6	0.33	3.1	0.39	3.1	0.39	2.1	0.27
S4	0.09	3.1	0.28	3.7	0.33	3.5	0.31	2.4	0.21
S5	0.06	2.5	0.15	3.9	0.24	3.6	0.22	3.7	0.23
W1	0.14	3.5	0.48	2.1	0.29	3.5	0.48	3.6	0.50
W2	0.15	3.2	0.47	1.3	0.19	2.7	0.39	3.5	0.51
W3	0.08	2.1	0.16	2.4	0.18	3.8	0.29	2.9	0.22
W4	0.07	2.3	0.15	3.1	0.21	1.5	0.10	2.1	0.14
W5	0.08	1.9	0.14	3.5	0.26	3.5	0.26	1.4	0.11
O1	0.10	3.2	0.32	3.6	0.36	3.4	0.34	2.7	0.27
O2	0.13	2.7	0.35	3.4	0.44	3.2	0.41	2.3	0.30
O3	0.11	2.3	0.26	3.1	0.36	3.1	0.36	2.5	0.29
O4	0.10	1.7	0.17	3.2	0.32	3.6	0.36	3.1	0.31
T1	0.13	1.6	0.20	2.1	0.27	2.5	0.32	2.1	0.27
T2	0.11	2.4	0.27	2.5	0.28	2.4	0.27	1.3	0.14
T3	0.10	3.2	0.30	2.5	0.24	2.8	0.27	3.4	0.32
T4	0.08	2.5	0.20	1.9	0.15	1.2	0.10	3.1	0.25
T5	0.14	2.6	0.37	1.8	0.26	2.1	0.30	1.2	0.17
SUM			*5.24*		*5.55*		*5.90*		*5.24*

		Competitive strategies					
Key factors	**Weight**	**WT1**		**WT2**		**WT3**	
		AS	**TAS**	**AS**	**TAS**	**AS**	**TAS**
S1	0.09	3.5	0.31	2.9	0.26	3.0	0.27
S2	0.13	3.3	0.44	2.8	0.37	2.7	0.36
S3	0.13	3.4	0.43	2.6	0.33	1.5	0.19
S4	0.09	2.3	0.21	3.1	0.28	3.2	0.29
S5	0.06	3.5	0.21	2.5	0.15	3.4	0.21
W1	0.14	2.2	0.30	3.5	0.48	2.9	0.40
W2	0.15	1.9	0.28	3.2	0.47	3.1	0.45
W3	0.08	3.5	0.26	3.2	0.24	3.5	0.26
W4	0.07	3.7	0.25	3.1	0.21	3.4	0.23
W5	0.08	3.2	0.24	3.6	0.27	3.2	0.24
O1	0.10	2.7	0.27	2.6	0.26	3.1	0.31
O2	0.13	2.9	0.37	2.9	0.37	3.7	0.48
O3	0.11	2.8	0.32	3.5	0.40	3.9	0.45
O4	0.10	3.2	0.32	3.4	0.34	2.1	0.21
T1	0.13	3.4	0.43	2.9	0.37	2.9	0.37
T2	0.11	3.6	0.40	2.6	0.29	2.8	0.31
T3	0.10	3.6	0.34	2.3	0.22	2.6	0.25
T4	0.08	3.1	0.25	2.4	0.19	3.1	0.25
T5	0.14	2.3	0.33	1.7	0.24	2.5	0.36
SUM			*5.97*		*5.74*		*5.87*

In the provided QSPM matrix, there are four types of strategies listed: offensive, competitive, conservative, and defensive. Each strategy type is evaluated against the identified key factors (S, W, O, T) by assigning a numerical value indicating the attractiveness score (AS) and then calculating the total attractiveness score (TAS). The higher the TAS, the more attractive the strategy.

5.4 Prioritisation of strategic alternatives

Table 6 summarises the relative importance of each of the prioritised options for the internal factors (strengths and weaknesses). Working together with technology vendors can benefit an organisation's offensive strategy in several ways. Collaboration with technology suppliers (SO4) is found to command the highest priority with a 6.09 attractiveness score. This option is employed when the organisation is pursuing offensive strategies. An organisation is actively exploring expansion prospects, entering new markets, or attempting to acquire a competitive advantage while it is pursuing offensive activities. Collaboration with technology providers can give organisations access to specialised knowledge and skills in the field of cutting-edge automotive technologies and thereby satisfy evolving demands from customers (Dwivedi et al., 2021). By investing in cutting-edge technologies, technology providers to the automotive sector frequently remain at the forefront of R&D. Organisations can have access to the most recent developments in fields, including electric vehicles, autonomous driving, connected automobiles, and vehicle-to-everything (V2X) communication by working with these vendors.

Table 6: Prioritisation of Strategies, based on QSPM

Strategies	Attractive score (SUM)	Priority
SO1	5.26	13
SO2	5.71	10
SO3	5.90	5
SO4	6.09	1
ST1	5.95	3
ST2	5.75	8
ST3	5.80	7
ST4	5.33	12
WO1	5.24	14
WO2	5.55	11
WO3	5.90	4
WO4	5.24	15
WT1	5.97	2
WT2	5.74	9
WT3	5.87	6

Collaborating with technology providers through efficient supply chain partnering earns the highest attractiveness score of 6.09. Efficient supply chain partnering facilitates cost-saving measures, waste reduction, workflow optimisation, and resource maximisation. This strategy is justifiable due to the emphasis on offensive strategies. Offensive strategies aim to bolster market share, streamline processes, and mitigate risks. In the automotive sector, cost reduction through effective supply chain management holds significant justification and importance given intense cost competition and pricing (Bendul, 2018).

In the Malaysian automotive sector, the options of cost optimisation (WO1) and collaborative supplier relationships (WO4), despite the necessity, garners the lowest appeal score of 5.24 each, relegating these two options to the bottom of strategic considerations. Given the intricate supply networks inherent in the sector, there is heavy reliance on international component sourcing (Alqasa & Sundram, 2024). However, the prospect of extensive cost optimisation spanning logistics, supplier development, and quality control becomes imperative in managing and coordinating a localised supply chain. This imperative arises from the potential complexities involved, particularly when localising component production. For instance, attempting to localise production within Malaysia could introduce significant challenges, especially in regions where infrastructure or a robust supply base is lacking (Katsaliaki et al., 2021) which necessitates substantial investments in infrastructure development, supplier capacity building, and quality assurance measures. Consequently, the allure of cost optimisation could be diminished by the perceived risks and complexities associated with restructuring the supply chain in a localised context (Sundram et al., 2018). Despite the potential long-term benefits, such as reduced dependence on international suppliers and enhanced control over production processes, the initial hurdles and investments required may dampen the attractiveness of this option in the Malaysian automotive sector.

6. Conclusion and Recommendations

Malaysia's automotive sector, though established with a cluster of local manufacturers and assemblers (including luxury car manufacturers and assemblers), and international component manufacturers, is considered a growing sector given the evolving global automotive landscape. The sector relies heavily on foreign suppliers for components (Dediu et al., 2018), such as engines, transmissions, electronics, and interior elements through the supply chain network because of limited local suppliers, and this exposes the sector to supply chain disruptions. Frequent changes in government regulations and policy (Chen et al., 2020), coupled with import levies and restrictions, have also increased uncertainty, impeded competition (Fritschy et al., 2019) and impacted long-term investments in this sector.

The key findings of the SWOT-QSPM reveal key insights: it enjoys a robust supply chain network and opportunities in the increasing demand for electric and hybrid vehicles. However, challenges such as strict emissions regulations and shifting consumer preferences threaten traditional manufacturing methods. To succeed amidst these challenges, embracing diversity and implementing competitive strategies are essential. Additionally, prioritising technological advancements to improve production efficiency is critical for navigating the dynamic automotive landscape. As such, the following are some recommendations based on the findings of this study.

Collaboration between government and business is essential for localising automotive component manufacturing by defining goals, and devising programmes to attract investment in local manufacturing through financial incentives, tax breaks, and subsidies (see also Belhadi et al., 2021). Collaborations with educational institutions, such as universities, technical colleges, and vocational training centres also need to be expanded to produce sector-relevant curricula and programmes and bridge the skills gap in this sector (see also Kamble et al., 2020).

Operations and procedures need to be streamlined and optimised through digitisation, such as with the use of integrated enterprise resource planning (ERP) systems, manufacturing execution systems (MES), and customer relationship management (CRM) software (see also Llopisi et al., 2021). Additionally, supplier communication channels need to be enhanced along with consistent, open channels of contact on requirements, expectations, and difficulties by using technology-enabled platforms, such as supplier portals, collaborative software, or shared project management systems, for real-time information transmission (see also Qureshi et al., 2018).

Authors' Contributory Statement

Raja Zuraidah Rasi contributed to the study's conceptualization, data collection, and manuscript revisions. Veera Pandiyan Kaliani Sundram, as the corresponding author, led the project, developed the research framework, and managed communication among authors. Ahmad Rais Mohamad Mokhtar conducted statistical analyses and provided critical feedback. Li Lian Chew contributed expertise in supply chain theories, while Evelyn S. Devadason provided insights from an economic perspective and ensured an accurate representation of economic fundamentals.

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Appendices

Appendix A: Strengths of the Automotive Sector

Proximity to major markets	Malaysia's automobile sector has access to a sizable consumer base due to its proximity to significant markets like Southeast Asia, China, and India. There is also a growing middle class in the domestic market generating demand for passenger cars.
Established automotive ecosystem	The mature automotive sector in Malaysia, led by Proton and Perodua, benefits from a strong ecosystem comprising domestic automakers, assemblers, and foreign component manufacturers. Eco-innovation is emphasised for sustainable development, driving growth across economic, ecological, and societal fronts. Both external factors like regulations and internal initiatives within companies drive eco-innovation. Scholarly research indicates that eco-friendly product innovation practices mediate the relationship between external pressures and internal performance, influencing environmental outcomes. Additionally, eco-innovation is pivotal in linking innovation strategy with firm performance, impacting organisational, product, and process dimensions (Holweg, 2018).
Government support and incentives	The Malaysian government actively incentivises investment in the automotive sector, offering tax exemptions for passenger vehicles and introducing stimulus programmes totalling USD127 billion since February 2020, including the Pemulih initiative in June 2021. These measures aim to support industrial and research development, though challenges such as the global semiconductor shortage may impact manufacturing despite tax incentives (Nazir et al., 2019).
High domestic demand	Malaysia's middle class is growing along with its population, which is driving up demand for new cars. The total sector volume (TIV), which had experienced two years of declining sales, recovered, and reached 720,658 units in 2022. The TIV 2022 also marked a new high point for automotive as annual sales exceeded 700,000 units. In the fiscal year under review, the categories for passenger and commercial vehicles both experienced extremely strong sales growth. In 2022, there were 641,773 new passenger vehicles registered, up from 452,486 (or 41.8%) in 2021. The commercial vehicles category also saw growth, rising by 39.9%, or 22,488 units, to 78,885 total units. Due to rising demand, businesses started to invest in anticipation of a recovery from the two-year depression brought on by the Covid-19 pandemic.
Skilled workforce	The automobile sector in Malaysia gains from a skilled labour force that supports its growth and competitiveness. The nation emphasises technical education and vocational training, and as a result, people are equipped with the necessary abilities for automotive engineering, production, R&D, and technical assistance. Many colleges produce engineering graduates with specialisations in a variety of automotive disciplines, and sector-driven training programmes bridge the knowledge gap by ensuring that graduates have both practical skills and sector knowledge. Companies provide training programmes to keep employees up to date on recent advancements and promote continuous learning and skill development. Malaysia's multilingual workforce also benefits from the multicultural environment, which fosters effective communication and collaboration with international partners. Overall, Malaysia's automotive sector is more globally competitive because of its skilled workforce, which enables complex production procedures, innovation, and technological adaptation (Qureshi, 2018).

Appendix B: Weaknesses of the Automotive Sector

Dependence on imported components	The automotive sector's dependency on imported components makes it susceptible to supply chain disruptions caused by various factors such as geopolitical tensions, trade disputes, natural disasters, or logistical challenges. These disruptions can lead to production delays, increased costs, and revenue losses for automakers, affecting their ability to meet consumer demand. The Covid-19 pandemic, as highlighted by Cai and Luo (2020), severely impacted production by disrupting the supply of raw materials and spare parts, affecting industries like automobiles, electronics, and machinery. Additionally, changes in demand volume and structure further exacerbated the sector's challenges. Wong (2020) and Cai and Luo (2020) described the pandemic's unprecedented effects, including supply chain and distribution disruptions, decreased domestic demand, global loss of confidence, stock market volatility, and shifts in consumer behaviour.
Limited local supplier base	Access to novel technology and advanced components may be constrained due to a limited local supply base. The automobile business is continuously expanding, with ongoing developments electric automobiles, self-driving cars, and connectivity. Malaysian automakers may have hurdles in implementing cutting-edge technology into their vehicles if their local supplier base cannot design and build cutting-edge components. This might make it difficult for them to compete with global peers and fulfil changing client expectations. Accenture (2020) pointed out four major challenges to the automobile sector amid the Covid-19 crisis: the supply shortage of vehicle parts, a manufacturing shutdown, a decline in vehicle sales, and a drop in working capital and liquidity. Worldwide, automobile production is highly dependent on the exports of automobile parts from China.
Lack of innovation and weak brand image	The possibilities for Malaysia's automotive sector's long-term growth are seriously hampered by a lack of innovation. The sector runs the risk of stagnating in terms of product offers, which results in a lack of differentiation and an inability to satisfy changing consumer needs. This may lead to the loss of opportunity to profit from new market trends like electric automobiles and cutting-edge technology (Anazawa, 2021). Additionally, the sector's capacity to stay technologically competitive and create value-added services is hampered by a lack of investment in R&D and cooperation with sector players. The Malaysian automotive sector must actively embrace evolving trends and technologies, prioritise innovation, invest in R&D, and create collaborations to compete in export markets and ensure long-term growth.
Limited R&D capabilities	Malaysia's automobile sector has insufficient R&D capabilities. Although the nation possesses a trained labour force, compared to other significant automotive manufacturers, there is a dearth of investment in R&D. The sector's capacity to innovate, create cutting-edge technologies, and maintain the vanguard of automotive trends is hampered by inadequate R&D spending (Wong et al., 2020). The Malaysian automotive sector can be encouraged to innovate and create new technologies by improving the R&D infrastructure and encouraging partnerships between business stakeholders, academic institutions, and research organisations.

Appendix C: Opportunities in the Automotive Sector

Increasing regional integration	Malaysia is part of the ASEAN Economic Community (AEC), which aims to promote regional integration and the free movement of goods, services, and skilled labour. This integration creates opportunities for automotive supply chain management, including streamlined logistics, harmonised regulations, and expanded market access (Mohd Yusoff, 2019).
Growth in the ASEAN market	The regional market is one of the fastest-growing automotive markets in the world, which presents significant opportunities for Malaysian automotive manufacturers. Among the ASEAN nations, Malaysia holds a prominent position as a potential hub for automobiles. The government has implemented favourable policies and incentives to attract investments and stimulate further expansion in the ASEAN market (Mohd Yusoff, 2019).
Adoption of advanced technologies	The automotive sector was the first to deploy VR technology, followed by suppliers, constructions, powerhouses, health and diagnosis. The automotive sector is experiencing a digital transformation through technologies such as IoT, AI, and blockchain. Malaysia can embrace these technologies to improve supply chain visibility, enhance operational efficiency, and reduce costs.
Expansion into new markets	Malaysia has a well-developed automotive manufacturing sector with a strong manufacturing infrastructure and expertise. The presence of international automotive manufacturers and their production facilities in Malaysia indicates the country's ability to meet global manufacturing standards. This established manufacturing base provides a solid foundation for expansion into new markets, as it demonstrates Malaysia's capability to produce high-quality vehicles and automotive components (Mohd Yusoff et al., 2019).

Appendix D: Threats to the Automotive Sector

Global trade uncertainties	The automotive sector is highly influenced by global trade dynamics, including trade wars, tariffs, and trade agreements. Changes in trade policies and protectionist measures can disrupt the automotive supply chain and impact Malaysia's position as an automotive hub (Holweg et al., 2021).
Changing regulations and compliance.	Regulations related to emissions, safety standards, and environmental protection are becoming more stringent worldwide. Compliance with these regulations requires significant R&D investments, as well as production upgrades. Non-compliance or delays in adapting to changing regulations can result in penalties, reputational damage, and restricted market access. Keeping up with evolving regulations poses a threat to the sector's competitiveness and profitability. The underlying technology has also advanced significantly, assisting in market diversification through the rising popularity of diesel, hybrid, and complete EVs (Quah et al., 2021). Changes in the regulatory environment and local manufacturing have also revolutionised the sector, making more efficient automobiles more available to the public.
Intense regional competition	Malaysia faces competition from neighbouring countries, such as Thailand and Indonesia, which also have strong automotive industries. These countries offer competitive incentives, lower labour costs, and larger domestic markets. Malaysia needs to continuously improve its supply chain management practices to remain competitive in the region (Akgün, 2019).
Adapting to the changing consumer preferences	The automotive sector is witnessing a shift towards connected and autonomous vehicles. Malaysian manufacturers should invest in technologies that enhance connectivity, such as advanced information systems, telematics, and autonomous driving features. By integrating smart features and connectivity options, manufacturers can cater to tech-savvy consumers who seek convenience, safety, and a seamless digital experience in their vehicles. (Quah et al., 2021).
Impacts of economic downturns	Economic downturns have a significant impact on consumer spending patterns, including the demand for new vehicles. During an economic downturn, consumers often experience reduced disposable income and financial uncertainty. This leads to a decline in purchasing power, making new vehicles a less affordable option for many individuals. As a result, demand for new vehicles is likely to decrease, posing a threat to the automotive sector (Holweg et al., 2018).