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An Investigation of Consumer Perspectives on the Exterior Design Transition from Internal Combustion Engines to Electric Vehicles in Malaysia

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Abstract
The adoption of electric vehicles (EVs) in Malaysia faces barriers such as limited charging infrastructure, high import taxes, inadequate policy support, and cost-ineffective design. This study explores how driving experiences, personal interests, social influences, environmental concerns, and government policies shape consumer intent to transition from internal combustion engines (ICEs) to EVs, with emphasis on exterior design as a transformative factor. Findings highlight the interplay of functional, aesthetic, and socio-cultural aspects that shape consumer behaviour. The study contributes insights for policymakers and industry stakeholders to foster EV adoption, aligning with Malaysia's sustainability goals and global mobility trends.

Keywords: Electric Vehicles; Exterior Design; Consumer Perspectives; Internal Combustion Engine

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1.0 Introduction

The global automotive industry is undergoing a paradigm shift, driven largely by the transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs). This transformation is propelled by environmental imperatives, technological innovations, and consumer demand for sustainable alternatives (International Energy Agency [IEA], 2023). In Southeast Asia, Malaysia is gradually positioning itself within this shift, though adoption rates remain modest compared to countries such as China and Japan (Fig. 1). The Malaysian automotive industry faces a unique combination of opportunities and barriers, shaped by policy, consumer behaviour, and cultural preferences.

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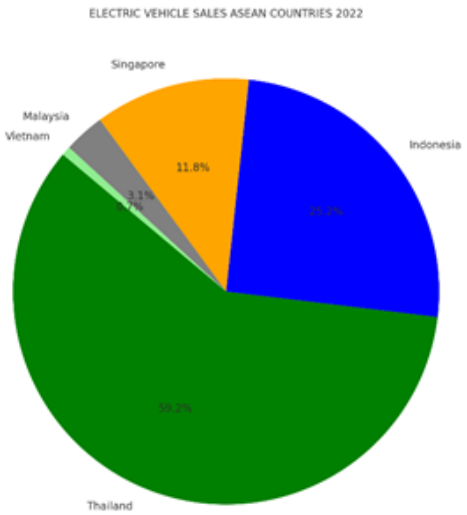

Fig. 1: Illustration of Electric Vehicle Sales in ASEAN Countries 2022.
(Source:) Adapted from Caricarz (2023), Counterpoint Global Passenger Electric Vehicle Model Sales Tracker, Q3 2022.

Academic research highlights that consumer perspectives remain central to EV adoption. Adnan et al. (2018) emphasised that Malaysians' decisions to adopt green technologies are closely tied to economic considerations, lifestyle factors, and symbolic associations. Similarly, Yan and Mohamed (2022) demonstrated that consumer buying intention for EVs in Malaysia is shaped by both practical concerns (cost, accessibility, and infrastructure) and psychological values such as prestige and environmental consciousness. This awareness is vital for both Malaysian researchers and transportation industry stakeholders (Sang & Bekhet, 2015; Yan & Mohamed, 2022a).

This study aims to shed light on significant challenges faced by consumers considering or transitioning from ICE vehicles to EVs. The analysis of previous literature reviews will provide insights into these issues, considering the recent emergence of EVs in Malaysia. This article also provides the following research questions and research objectives:

1.1 Research Questions

- What are the primary obstacles faced by Malaysian consumers in transitioning from internal combustion engines to electric vehicles, considering factors such as infrastructure, policies, and consumer perceptions?
- How does the user experience, including factors like charging infrastructure and design innovations, impact the adoption of electric vehicles among consumers in Malaysia?
- What insights can be derived from Malaysian customers' viewpoints on electric vehicles, particularly focusing on the exterior design transition and other factors influencing their preferences?

1.2 Research Objectives

- Pinpoint the key obstacles hindering Malaysian consumers from transitioning to electric vehicles, addressing challenges in infrastructure, policies, and consumer perceptions.
- Explore the impact of user-experience considerations, such as charging infrastructure and design innovations, on electric vehicle adoption in Malaysia.
- Formulate novel insights into Malaysian customers' viewpoints on electric vehicles, with a focus on the exterior design transition and factors influencing consumer preferences.

The present study situates itself at the intersection of consumer behaviour and automotive design, focusing specifically on the symbolic and functional implications of exterior design in Malaysia's EV market. While existing studies on EV adoption in Malaysia have largely prioritised infrastructural readiness, policy incentives, and technological performance (Muzir et al., 2022; Khazaei & Tareq, 2021; Hamzah et al., 2022), relatively limited attention has been paid to how consumers interpret the visual and symbolic transition from internal combustion engine (ICE) vehicles to electric vehicles. Exterior design serves not only as a functional enclosure but also as a communicative medium that conveys innovation, environmental responsibility, and social identity. In markets where EV technology is still emerging, such as Malaysia, design cues may play a more significant role in shaping consumer trust, familiarity, and perceived value, particularly when consumers have limited direct experience with electric vehicles. Visual continuity, perceived build quality, and recognizable automotive proportions may influence early-stage evaluation and reduce uncertainty during the decision-making process, especially among first-time EV adopters.

2.0 Literature Review

2.1 Global and Regional EV Trends

Globally, EV adoption has accelerated significantly, led by China, Europe, and the United States, with over 14 million EVs sold in 2023 alone (IEA, 2023). ASEAN markets, however, remain in an early stage of adoption, hindered by high purchase costs and limited charging infrastructure (ASEAN Automotive Federation, 2022). Malaysia, despite its national Low Carbon Mobility Blueprint 2021–2030, faces slow progress compared to Thailand and Indonesia, which have aggressively developed EV manufacturing hubs (Veza et al., 2022).

2.2 Green Mobility Trend in Malaysia

Malaysia's EV development is shaped by environmental commitments and economic strategies. The Low Carbon Mobility Blueprint (Ministry of Transport Malaysia, 2021) underscores targets for expanding EV penetration by 2030. However, challenges such as limited charging stations, weak integration with renewable energy, and high costs impede adoption (Muzir et al., 2022). Research suggests that, beyond policy and technology, cultural values and aesthetic preferences influence Malaysian consumers (Yan & Mohamed, 2022). These challenges suggest that EV adoption in Malaysia cannot be understood solely through technological readiness or policy frameworks, but must also account for consumer perception, familiarity, and acceptance within everyday mobility contexts.

2.3 Consumer Behaviour and EV Adoption

Consumer adoption of EVs has been linked to multiple factors, including social influence (Zhao et al., 2020), environmental concern (Viola, 2021), and personal innovativeness (Khazaei & Tareq, 2021). In Malaysia, studies indicate that purchase intentions are moderated by financial affordability and symbolic prestige (Adnan et al., 2018; Yan & Mohamed, 2022). Hamzah et al. (2022) also emphasised that the availability of after-sales service and brand trust remain crucial determinants. While these findings underscore economic and infrastructural considerations, they often overlook the symbolic power of design in shaping consumer adoption.

2.4 Exterior Design in Automotive Studies

Automotive design is not merely a matter of aesthetics but serves as a symbolic and functional communication medium between manufacturers and consumers. Research in product design suggests that national identity and cultural values often shape design perception (Abidin et al., 2016). Rosch, Simpson, and Miller (1976) argue through prototype theory that categorisation and recognition processes affect how consumers perceive typicality in design features. In the EV context, exterior design elements such as shape, lighting, and grille patterns communicate innovation, sustainability, and identity (Buhmann & Criado, 2023). In the context of electric vehicles, exterior design also functions as a transitional marker that distinguishes new mobility technologies from conventional automotive forms. The removal or reinterpretation of traditional ICE elements, such as grilles and exhaust-related features, introduces unfamiliar visual languages that may challenge consumer expectations. According to prototype theory, consumers often rely on familiar design cues to categorise and evaluate products (Rosch et al., 1976). When EVs deviate excessively from established automotive prototypes, they may risk being perceived as experimental or niche products. Conversely, designs that balance novelty with recognisable automotive characteristics may enhance acceptance by reducing cognitive and psychological distance. This theoretical perspective underscores the importance of exterior design as a mediator between technological innovation and consumer perception, particularly in markets where EV familiarity is still developing.

2.5 Conceptual Framework of the Study

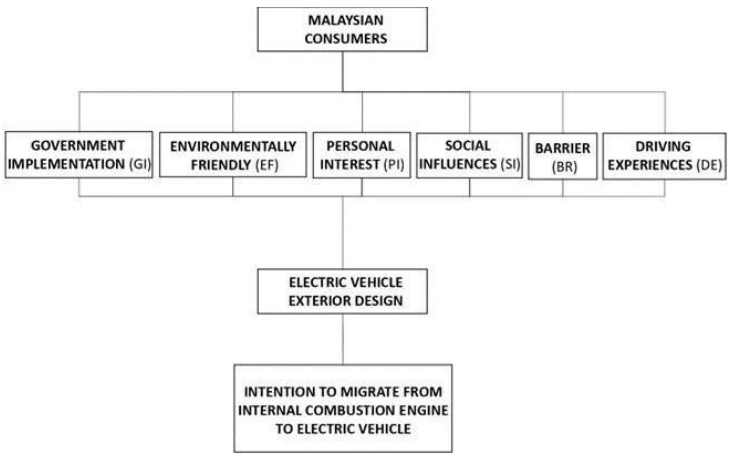

Fig. 2: Conceptual Framework of Study.

Fig. 2 presents the conceptual framework that guides the research. Building upon the previously discussed concepts in the literature review, this framework outlines the specific variables and their interconnections. The framework delves into the relationships between driving experiences, personal interests, social influences, barriers, environmental considerations, governmental initiatives, and, notably,

the transformative role of exterior design. All these factors collectively contribute to the intention to transition from internal combustion engines to battery electric vehicles. This comprehensive structure forms the foundation for investigating the complex dynamics and factors influencing individuals' decision-making regarding the adoption of electric vehicles, with a particular emphasis on how the exterior design shapes consumer preferences and perceptions in this transitional process.

3.0 Methodology

This study employed a systematic literature review approach to gather and analyse insights on Malaysian consumers' transition from internal combustion engine (ICE) vehicles to electric vehicles (EVs). The process was structured into three key stages.

a) Literature Search and Screening

A comprehensive search was conducted across academic databases and official reports to identify relevant studies. Sources were systematically screened to ensure relevance and quality, allowing the researcher to build a reliable foundation of materials.

b) Data Extraction and Analysis

Pertinent data were extracted from the selected literature, followed by critical analysis to uncover patterns, challenges, and opportunities. This stage emphasised identifying recurring issues and relationships between consumer behaviour, vehicle design, and adoption barriers.

c) Synthesising the Literature Review

Finally, the collected insights were integrated into a structured review. This synthesis guided the development of the conceptual framework and ensured a coherent presentation of findings.

The systematic data processing approach followed guidelines outlined in the *Handbook of E-Health Evaluation: An Evidence-Based Approach* (Chapter 9, NCBI Bookshelf, n.d.), which provided methodological rigour and structured guidance for reviewing and analysing literature. To strengthen the process, the researcher employed process prediction, a technique that anticipates possible consumer behaviours and adoption trends by interpreting sequential events.

For qualitative analysis, the software ATLAS.ti (Hwang, 2008) was utilised to code, categorise, and identify emerging themes across the literature. This enabled the detection of patterns related to consumer perceptions, infrastructure barriers, design expectations, and policy influences. Additionally, asset records were referenced to supplement the dataset, ensuring comprehensive coverage of industry reports and empirical studies. This methodology allowed the researcher to uncover nuanced insights into the interplay between consumer perceptions and the exterior design of EVs, forming a strong basis for analysis.

4.0 Findings

The data collected through the systematic review were meticulously documented and analysed using ATLAS.ti. Findings were categorised into three overarching themes: Design, Function, and Issues, which provided a structured framework for interpreting the results. These themes were then expanded into specific dimensions, including Driving Experiences, Personal Interest, Social Influences, Barriers, Environmental Friendliness, Government Implementation, and Intention to Migrate from ICE to EVs. This thematic structure not only ensured comprehensive coverage of consumer perspectives but also aligned directly with the study's conceptual framework (Figure 3). Through this approach, the analysis highlights how consumer behaviour, infrastructural limitations, and design considerations intersect in shaping the adoption of EVs in Malaysia.

4.1 Driving Experiences

One of the primary determinants influencing Malaysian consumers' willingness to transition from ICE to EVs is driving experience. Literature reveals that while affordability and infrastructure remain critical, consumers still prioritise vehicles that are enjoyable to drive and aesthetically appealing. Features such as swift acceleration, smooth handling, and quiet operation enhance the overall driving experience and make EVs attractive options, with exterior design serving as a vital complement. Demographic insights suggest that early adopters are more likely to be male, well-educated, high-income individuals aged between 29 and 39. Affordability remains an issue, as reflected in the Ora Good Cat is Malaysia's most affordable EV at RM139,800 (Paultan.org, n.d.). Moreover, education plays a role in shaping awareness of technological advancements, influencing adoption. Functionally, charging infrastructure and safety concerns, such as EVs' silent operation, remain barriers.

4.2 Personal Interest

Personal innovativeness and individual risk-taking also shape consumer preferences for EVs. Literature shows that Malaysians interested in novel technologies are more likely to adopt EVs despite concerns about range anxiety and charging limitations. However, limited BEV models in Malaysia compared to plug-in hybrid vehicles (PHEVs) constrain consumer choice. The cost barrier, coupled with maintenance and battery replacement expenses, restricts EVs to T20 and M40 households. Importantly, exterior design continues to play a role in driving personal attachment to vehicles, reinforcing adoption decisions.

4.3 Social Influences

Social influence emerges as another pivotal factor. Celebrities, influencers, social media campaigns, and existing EV users (e.g., MyEVOC club) significantly shape consumer interest. Such social agents not only promote the functional benefits of EVs but also elevate

their symbolic and aesthetic appeal. Exterior design, in particular, has been identified as a social status marker, influencing younger consumers who perceive EVs as stylish and eco-friendly.

4.4 Barriers

Barriers to adoption are multifaceted, encompassing cost, infrastructure, limited local manufacturing, inadequate policies, and scarcity of service points. The lack of model variety and high import taxes amplify consumer hesitation. Safety concerns regarding EVs' near-silent operation also persist, particularly for pedestrians and the visually impaired. While noise reduction is environmentally beneficial, literature highlights the trade-off between quieter streets and safety concerns.

4.5 Environmental Friendliness

EVs are widely recognised as environmentally superior to ICE vehicles, reducing greenhouse gas emissions and air pollutants (EDF, n.d.). However, literature indicates that while environmental concerns influence consumer attitudes, cost and accessibility remain stronger decision-making factors. Total Cost of Ownership (TCO), which includes purchase, maintenance, and energy expenses, is a key determinant. Exterior design reinforces consumers' perception of EVs as modern, sustainable products, increasing their appeal.

4.6 Government Implementation

Government intervention plays a decisive role in EV adoption. Malaysia's Low Carbon Mobility Blueprint (2021–2030) aims to install 10,000 EV charging stations by 2025, with support from private players like DHL and Starbucks introducing charging facilities. Policies also include tax incentives, reduced annual fees, and infrastructure development. However, the higher cost of EVs compared to ICEs continues to limit uptake. Literature emphasises that government efforts must combine both functional incentives and symbolic design promotion to boost consumer confidence.

4.7 Intention to Migrate from ICEs to EVs

The synthesis of these factors demonstrates that Malaysian consumers' intentions to migrate from ICE to EVs are shaped by an interplay of design, function, social influence, and policy. Driving pleasure, affordability, social validation, and environmental consciousness all contribute to shaping adoption. Yet barriers such as cost, limited infrastructure, and safety concerns constrain growth. Literature underscores that exterior design, as both a functional and symbolic attribute, is critical to bridging these gaps by enhancing consumer perception and increasing EV desirability.

5.0 Discussion

5.1 Design as a Determinant in EV Adoption

Findings confirm that exterior design plays a significant role in shaping consumer acceptance of EVs in Malaysia. While prior studies highlighted infrastructure and affordability (Muzir et al., 2022; Yan & Mohamed, 2022), this research positions design as equally influential. This reflects global industry practices where manufacturers like Tesla, BYD, and Nissan utilise distinct design language to signal innovation (IEA, 2023). Within Malaysia, however, adaptation of design strategies must consider local cultural preferences and symbolic meanings (Abidin et al., 2016). Within the Malaysian context, exterior design appears to function as both an assurance mechanism and a value signal. For consumers who remain uncertain about EV performance, maintenance, and long-term reliability, design quality becomes a proxy for technological maturity and brand credibility. Vehicles that project refinement, robustness, and continuity with established automotive design norms may therefore reduce perceived risk. At the same time, futuristic or minimalist design elements communicate alignment with global sustainability narratives and advanced technology. This dual role suggests that EV exterior design must negotiate between innovation and familiarity. Rather than adopting radically unconventional forms, manufacturers targeting the Malaysian market may benefit from design strategies that integrate progressive visual elements while maintaining a recognisable automotive identity.

5.2 Policy and Market Implications

Government efforts, such as the Low Carbon Mobility Blueprint, must recognise that beyond incentives and infrastructure, design preferences influence adoption. Policies encouraging collaboration between policymakers, automakers, and design institutions could foster EVs that resonate with Malaysian consumers both functionally and symbolically (Ministry of Transport Malaysia, 2021). This also aligns with studies by Hamzah et al. (2022), which highlight trust and familiarity as prerequisites for adoption.

5.3 Theoretical Contributions

This research contributes to the body of consumer behaviour literature by integrating prototype theory (Rosch et al., 1976) with symbolic design studies (Abidin et al., 2016). It demonstrates that consumers categorise EVs not only on technological attributes but also on design cues that signify sustainability and modernity. This integration extends existing consumer behaviour models by demonstrating that symbolic interpretation of exterior form operates alongside functional evaluation in shaping adoption intention. In emerging EV markets, where experiential exposure remains limited, consumers rely more heavily on visual cues to infer performance, sustainability,

and social meaning. By positioning exterior design as a cognitive and symbolic interface between consumers and new automotive technologies, this study provides a more nuanced understanding of how design mediates technological acceptance beyond purely economic or infrastructural considerations.

5.4 Practical and Industry Implications

The findings of this study carry important implications for both automotive manufacturers and policymakers involved in Malaysia's electric vehicle ecosystem. From an industry perspective, the results suggest that exterior design should be treated as a strategic component of EV development rather than a secondary aesthetic consideration. In an emerging market such as Malaysia, where consumer familiarity with EV technology remains limited, exterior design serves as an initial point of engagement that shapes first impressions, perceived reliability, and brand credibility. Manufacturers that successfully balance innovative visual language with recognisable automotive forms may reduce consumer uncertainty while simultaneously communicating technological advancement and environmental responsibility. For policymakers, these findings indicate that existing EV initiatives may benefit from broader consideration of consumer-facing factors beyond infrastructure provision and financial incentives. While charging networks and tax exemptions remain essential, public awareness campaigns that highlight EV design, safety, and everyday usability may strengthen public acceptance. Integrating design narratives into national EV promotion strategies could help reposition electric vehicles not merely as environmentally responsible alternatives, but as desirable and culturally relevant products aligned with Malaysian lifestyles. In addition, collaboration between government agencies, automotive manufacturers, and design institutions may play a critical role in advancing locally resonant EV design solutions. Such partnerships could encourage the development of EVs that reflect regional preferences, climatic conditions, and cultural expectations, thereby enhancing market fit. By addressing both functional performance and symbolic meaning, these collaborative efforts may accelerate consumer confidence and contribute to a more sustainable transition from internal combustion engine vehicles to electric mobility in Malaysia.

6.0 Conclusion & Recommendations

This study highlights that EV adoption in Malaysia is influenced by a complex interplay of affordability, infrastructure, environmental concerns, and, critically, exterior design. While functional barriers such as cost and charging availability remain significant, findings indicate that exterior design plays a meaningful role in shaping consumer perceptions, trust, and purchase intention. Design operates not only as an aesthetic attribute but also as a symbolic indicator of innovation, sustainability, and lifestyle alignment. These findings expand existing understandings of EV adoption by positioning design as a cultural and psychological determinant alongside economic and technological factors. It is therefore recommended that policymakers incorporate design awareness into national EV strategies and encourage collaborations between automotive manufacturers and design institutions. Future research may extend this inquiry through empirical studies or cross-cultural comparisons within ASEAN markets to further examine how symbolic interpretations of EV design vary across socio-cultural contexts, particularly within rapidly urbanising Malaysian mobility environments.

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Paper Contribution to the Related Field of Study

This study contributes to three domains: design methodology by contextualising EV aesthetics in Malaysia, consumer behaviour research by linking symbolic and functional design attributes to purchase intention, and sustainable transportation policy by providing evidence-based recommendations for accelerating EV adoption.

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