Identifying Consumer Preferences for Electric Vehicles in Malaysia through the Garrett Ranking Analysis

Siti Norleena Wan Ab Aziz[1], Nizam Ahmat[1]*, Muhammad Najit Sukemi[1], Mohd Nasir Nawawi[1], Mahirah Kamaludin[1], Zuroni Md Jusoh[2]

[1]Faculty of Business, Economics and Social Development, Universiti Malaysia Terengganu, 21030 Kuala Nerus, Terengganu, Malaysia

[2]Faculty of Human Ecology, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia

*Corresponding author : nizamahmat@umt.edu.my

ABSTRACT

A vital way of addressing problems such as the changing climate and high carbon emissions is transitioning to electric vehicles (EVs). For the current study, an investigation was conducted into the principal preference factors and levels of awareness affecting the EV-related preferences held by consumers in Malaysia. To assess these aspects, 417 respondents (N=417) from Kuala Lumpur and Selangor were issued with a structured questionnaire that captured data from those using EVs, potential EV users, and non-EV users. The Garrett Ranking Analysis was used to identify priority attributes in terms of influencing the preferences of consumers. These included price, maintenance costs, charging duration, infrastructural provision, the performance and design of vehicles, safety features, policy incentives, and reductions in carbon emissions (CO_2). The findings show that the environmental impact (52.72%), vehicle design (50.73%), and infrastructure availability (50.34%) are the leading considerations in EV preferences, whereas charging time (49.46%), maintenance cost (49.06%), and cost saving (48.21%) were identified as the lowest ranked. This study provides insights for policymakers, automotive stakeholders, and sustainability advocates to accelerate the adoption of EVs in Malaysia.

KEYWORDS: Garrett ranking analysis, Sustainability awareness, Electric vehicles (EVs), Consumer preferences, Malaysia

Received 10 September 2025; Revised 22 December 2025; Accepted 6 January 2026
Doi: https://doi.org/10.59953/paperasia.v42i1b.900

1. INTRODUCTION

The increase in carbon dioxide (CO2) emissions due to rapid demand in the transportation sector has become a global concern. The transportation sector in Malaysia contributes 28% of the country's carbon emissions, 85% of which come from land transportation (Rahman et al., 2023). In Malaysia, 80% of land transportation still relies on fuel. This situation indicates the urgency of finding alternatives, such as EVs, in order to ensure a cleaner transition. Therefore, the Malaysian government is trying to increase the use of EVs, in alignment with the Malaysian Green Technology Policy (2019), which aims to reduce conventional vehicles through collaboration between the government and the automotive industries. There has been a significant increase in the usage of EVs. In 2021, only 278 EV units were sold. However, sales increased by 2,631 units in 2022, and, in 2023, sales increased to 10,159 units. By the end of 2024, sales had increased to 14,800 units, and, as of July 2025, the figure had reached 17,143 units (Malaysian Automotive Association, 2025). Regarding the growth of EVs, infrastructure has become a critical need. In 2023, 1,430 public charging ports were recorded, and the number had increased to 3,611 ports by the end of 2024. However, the ratio of chargers to vehicles remained at 1:20, below the benchmark set at 1:10 (Ministry of Investment, Trade and Industry (MITI), 2024; Malaysian Automotive Association, 2025). To extend the use of EVs, the government is targeting 10,000 public EV charging ports by the end of 2025.

Although government policies and industry initiatives have helped create momentum in recent years, the transition to electric mobility in Malaysia still largely depends on consumer attitudes and preferences. Most previous studies focused on economic and technical factors. In addition, they relied on regression models and structural equation modelling (SEM) to analyse consumer behaviour (Han & Liu, 2019; Hair et al., 2021). Regression and SEM techniques are effective in showing relationships among variables, but they do not clearly

present the order of importance of consumer priorities. Several decision-making techniques, including the Analytic Hierarchy Process (AHP), Best–Worst Method (BWM), and Conjoint Analysis, can recognise how to rank alternatives or determine factor importance (Saaty, 2008; Louviere et al., 2010; Rezaei, 2015). Nevertheless, such methods often require extensive comparisons or controlled experiments. Conversely, the Garrett Ranking Analysis provides a simpler yet systematic procedure to transform respondents' rankings into a clear hierarchy of factors (Garrett & Woodworth, 1969; Pandey & Verma, 2019).

Malaysia has implemented several national initiatives, such as import duty exemptions, specific road tax policies, and the National Energy Transition Roadmap, to accelerate the transition towards electric mobility. Even though such endeavours have been undertaken, insufficient studies have been conducted to examine the preferences of consumers and behavioural motivation with regard to EV adoption in the context of Malaysia. A number of concerns explain the ongoing low rate at which consumers use EVs, despite the potentially positive trend. In the current study, the primary considerations influencing the EV preferences of consumers were identified using the Garrett Ranking Analysis. This approach offers a definitive picture of these preferences, organised hierarchically. A greater comprehension of factors regarded as priorities might enhance consumer preferences and make a contribution to eco-friendly mobility, supporting the national goal for Malaysia to reach a low-carbon, sustainable future.

2. LITERATURE REVIEW

The transport sector is a major driving force behind climate change, given its long-recognised role as a primary contributor to greenhouse gas emissions. The latest research continues to uphold the argument that a key motivator for people to adopt EVs is greater environment-related awareness. For example, in examining suburban communities in the East Coast region of Malaysia to determine their EV preferences, Ahmat et al. (2024) discovered that consumers' interests were substantially affected by environmental consciousness and perceptions that EVs could reduce CO2 emissions. Based on their results, EV adoption could be accelerated by augmenting the general understanding that EVs benefit the environment. An especially crucial aspect is improving public knowledge about ongoing developments, such as the infrastructure for charging and policy support. The current challenges have led policymakers and academics to pay greater attention to mobility alternatives based on sustainability. Consumers are also demonstrating more interest in EVs, hence the rising number of investigations into factors influencing preference patterns within this group (Chu et al., 2022; Ahmad et al., 2024). This growing EV use has resulted in more academics focusing on these factors. In the existing works, emphasis has been placed on comprehending preferences among consumers, which develop significantly due to economic, technical, social, and environmental aspects. Meanwhile, the factors cited most frequently include prices, maintenance costs, charging duration, EV performance, safety features, access to infrastructure, and environmental impacts.

Research by Wong et al. (2023) revealed various factors affecting EV acceptance among consumers, including concerns about the environment, costs, the infrastructure for charging, government policy, energy-efficient processes, and social impacts. Despite the useful revelations arising from this study, it failed to categorise the factors into a definitive importance ranking. To bridge this knowledge gap, the current work applied the Garrett Ranking Analysis, enabling a more straightforward creation of a systematically organised consumer preferences hierarchy.

A key concern related to EVs is the price of these vehicles (Hidrue et al., 2011; Rezvani et al., 2015), with possible buyers often being dissuaded by their substantial initial cost. The consumer may be unwilling to purchase an EV as the upfront price is higher than that of a standard vehicle, notwithstanding the clear money-saving possibility in the long run. The middle-income segment also faces the barrier of affordability (Oliveira et al., 2015; Chu et al., 2022). Research has indicated (Sierzchula et al., 2014) that the willingness of consumers to purchase an EV is considerably affected by policy incentives and individual incomes. While Budget 2024 in Malaysia saw the introduction of exemptions from import duty and reduced road tax as policy incentives, the widespread adoption of EVs is still hampered by issues of affordability (Ministry of Finance Malaysia, 2024).

A further factor, maintenance costs, is frequently disregarded, even though EVs offer a major benefit in this area. The majority of buyers fail to realise that these vehicles can incur lower costs because they have fewer moving parts and do not need oil changes. According to Logtenberg et al. (2018), fuel consumption and maintenance can be as much as 71% lower in EVs in comparison with standard vehicles. U.S. Department of Energy (2021) figures show that an EV generally has lower maintenance requirements because less wear is experienced by features like the brakes and motor, which means the owner saves money in the long run. Owning an EV brings about long-term financial advantages, yet the typical consumer still lacks correct information about the operational cost-saving opportunity. This knowledge deficiency tends to result in misconceptions about EVs being expensive to maintain or having a reduced lifespan in comparison to regular

cars. Research in Malaysia and other Asian countries (such as China, Thailand, and Indonesia) suggests that purchasers have a tendency to underestimate long-term savings while overestimating maintenance and battery replacement costs (Wang et al., 2023; Li et al., 2023). Therefore, the total cost of ownership (TCO) is still perceived as being higher than the real cost. Such misunderstandings might prevent consumers from being willing to use an EV, even with policy incentives and better technology (Rahman et al., 2023).

Two other key consumer preference challenges are the charging infrastructure and duration. Consumer confidence regarding the use of EVs can be affected by these aspects. According to reports by Anegawa (2010) and Martin et al. (2009), a reliable charging network is crucial to increased EV use. EVBoosters (2023) stated that consumer readiness to transition to EVs is shaped significantly by the speed of charging because a longer charging duration could impair perceptions that EVs are convenient and practical. Meanwhile, Nazari et al. (2023) discovered that limited options to charge an EV led to frequent range anxiety experiences among drivers, who subsequently became discouraged from selecting an EV as their vehicle. Current Malaysian policy initiatives like the National Energy Transition Roadmap (Ministry of Economy, 2023) and Malaysia's Budget 2024 (Ministry of Finance Malaysia, 2023) represent steps taken to expand the charging infrastructure, while exemptions from road tax and reduced import duties have also been introduced. These schemes reflect the commitment of the government to accelerate the uptake of EVs. Reliable charging accessibility will reduce psychological barriers that are commonly associated with EV users, such as range anxiety (Wang et al., 2023).

Vehicle performance is another factor that determines EV preferences. Gunawan et al. (2022) showed that consumers are more interested in acceleration, power delivery, and a smooth driving experience. Modern EVs have all the capabilities to outperform traditional conventional vehicles in many ways. However, concerns about safety features, like excessively high-voltage batteries, became one of the most questioned issues among consumers. However, Zhao et al. (2024) reported that EVs were designed with more sophisticated vehicle technology and equipped with intelligent systems, making them safer than their gasoline counterparts. EVs are powered by electric drive systems and integrate advanced automotive technologies, including driver-assistance systems (ADAS), regenerative braking features, and connected digital interfaces; collectively, these enhance vehicle performance and the driving experience.

Many studies have focused on statistical methods via regression or SEM, such as the Analytic Hierarchy Process (AHP), Best–Worst Method (BWM), Conjoint Analysis and Multidimensional Scaling (MDS). These approaches are useful for complex decision-making and structured comparisons, but they are usually time-consuming and more suitable for smaller datasets. This study addresses this gap by using the Garrett Ranking Analysis, which ranks the responses collected from consumers to identify which are the most preferred. Loganathan et al. (2021) used the Garrett Ranking Analysis and found this method to be highly effective with preference data. This study is vital for shaping policy and market strategies, as well as moving towards low emissions of CO_2. **Table 1** summarises the key factors, typical findings, and sources from previous studies on EV.

3. METHODOLOGY

This research used a structured questionnaire that was developed based on a literature review. Experts validated the questionnaire to ensure it would be clear and relevant. Stratified random sampling was used to collect data from 417 respondents from Kuala Lumpur and Selangor, including EV users and those not using EVs.

Table 1: *Summary for literature review*

Factor	Findings from previous studies	Source
Purchase Price	High initial cost remains a key barrier to EV adoption	(Hidrue et al., 2011; Rezvani et al., 2015; Chu et al., 2022).
Maintenance Cost	EVs have lower maintenance costs due to fewer moving parts	(Logtenberg et al.,2018).
Charging Infrastructure	Limited availability of charging stations discourages EV purchase	(Martin et al., 2009; Anegawa, 2010).
Vehicle Performance	Consumers are attracted by acceleration, power delivery, and smooth driving	(Gunawan et al., 2022)
Safety Features	Modern EVs include advanced battery and safety systems that enhance user confidence	(Zhao et al., 2024).
Environmental Concern	Greater environmental awareness promotes EV acceptance	(Wong et al., 2023).
Social Influence	Peer influence and social encouragement increase EV adoption	(Ahmad et al., 2024).
Consumer Knowledge / TCO Perception	Many consumers overestimate EV costs and underestimate long-term savings	(Li et al., 2023; Rahman et al., 2023).
Range Anxiety	Fear of battery depletion limits adoption, especially where charging is scarce	(Wang et al., 2023).

Within these strata, respondents were also organised into age and income group categories so that diverse demographic attributes could be captured.To construct the sampling frame, information was used from localised community networks of EV users, of which MyEVOC was one example. In public places, such as malls, transportation hubs, and commercial centres, potential respondents were approached at random. Data collection occurred in person and via online platforms. The questionnaire's clarity and consistency were assessed through a pilot study. This involved 50 individuals from the Malaysian Electric Vehicle Owners Club (MyEVOC). Satisfactory internal consistency was revealed by the reliability analysis, which produced Cronbach's alpha values of 0.858 and 0.807 for the awareness and attitude factors, respectively.

3.1 Sample Size

The adequacy of the sample size was assessed according to the guideline proposed by Comrey and Lee (1992), which classifies a sample of 200 as good and one of 300 or more as very good for behavioural and multivariate studies. The total of 417 valid responses collected in this study exceeded the recommended guideline, ensuring sufficient representation for a reliable ranking analysis. Considering the study's focus on consumer preferences for EVs across two major regions (Kuala Lumpur and Selangor), this sample size was also consistent with the guideline developed by Krejcie and Morgan (1970), who suggested that sample sizes above 380 are adequate for populations exceeding 100,000. Thus, the number of respondents achieved was statistically sufficient for the intended analysis.

3.2 Research Instrument

The questionnaire was built based on past research. It was designed and validated by field experts through pilot testing. Ethical approval for this research was granted by the Universiti Malaysia Terengganu Research Ethics Committee (UMT REC), with approval reference number UMT/JKEPM/2024/250. All responses were kept anonymous, and the collected data were treated with strict confidentiality and used solely for academic purposes.

3.2.1 Structured Questionnaire

This study concentrated solely on section demographics, which involves 12 items related to the respondent profile and consists of gender, age, race, educational level, occupation, monthly income, area, and type of EV. The next section on ranked preferences involved ranking eleven key preference factors.

3.2.2 Data Collection Method

Data were collected using two methods, face-to-face and online. Through the former, questionnaires were distributed to designated respondents in strategic areas such as shopping malls, commercial areas, and public locations near transportation stations. Among the main locations selected were Masjid Jamek, Shah Alam, Gombak, and Mont Kiara. Based on the Malaysia Automotive, Robotics and IoT Institute (MARii, 2023), Selangor and Kuala Lumpur are the main EV growth centres in Malaysia. In addition, data from PlugShare (2024) and EV Connection (2024) state that the Masjid Jamek and Gombak areas are active locations for EV users. This data collection used face-to-face and online methods, in collaboration with MyEVOC (Malaysia EV Owners Club). The physical collection was assisted by hired enumerators.

3.3 Ranking Method

Phutong et al. (2024) used the ranking method in Thailand to identify key attributes like price, infrastructure, and environmental impact. This method is useful in determining prioritised attributes. The ranking results provide input for decision-making about EV preferences. For example, if a respondent selected their first choice (rank 1) and second choice (rank 2), the subsequent attributes were assigned as ranks 3, 4, and 5. **Table 2** presents the ranked factors regarding consumer EV preferences.

Table 2: *Ranked factors on consumer EV preferences*

No.	Key Factors Consumer Preferences on EV	Level of priority (1–11)
1	Price	
2	Maintenance expenses (vehicle maintenance) -battery maintenance -electric motor -charging system	
3	Cost saving (no fuel dependency)	
4	Charging time	
5	Range anxiety	
6	Infrastructure (public charging station)	
7	EV car design (sleek and modern) -outer and inner design car	
8	Performance of EV	
9	Safety features -collision safety design -emergency notification system -smart key -strong vehicle structure	
10	Policy Incentives from the government	
11	Reducing CO_2	

3.3.1 Analysis using the Garrett Ranking Analysis

The following analysis examined the prioritisation of factors influencing EV preferences among both EV users and non-EV users. The Garrett Ranking Analysis was applied to identify the order of importance systematically. To minimise possible ordering bias, respondents were first instructed to read all eleven listed factors before assigning their rankings. The items were in randomised order, as recommended by Garrett and Woodworth (1969), to reduce positional influence. In situations where respondents gave the

same rank to multiple factors, an average Garrett score was computed for those items, as suggested by Loganathan et al. (2021). These procedures were followed to ensure that the ranking outcomes would genuinely represent respondents' priorities, rather than being affected by the order of item presentation or ranking bias. This method utilised data from Section A(ii) of the questionnaire, where respondents were asked to rank their preferences across eleven related factors. This practice allowed ordinal data to be converted into numerical scores using the Garrett conversion table. These preferences were listed from ranks 1 (most important) to 11 (least important), based on their perceptions and experiences. Based on Equation (1), the assigned ranks were converted into scores according to the percentage position formula proposed by Garrett and Woodworth (1969), as follows:

$$\text{Percentage position} = 100 \times \frac{\text{Rij} - 0.5}{\text{Nj}} \quad (1)$$

Where:

Rij = rank given to the ith factor by the jth respondent,
Nj = total number of factors ranked (in this study, Nj = 11)

The resulting percentage values were then converted into Garrett scores using the Garrett conversion table (Garrett & Woodworth, 1969) to obtain the corresponding scores. The total Garrett scores for each factor were aggregated across all the respondents, and the average score was derived by dividing the total by the number of participants. The factor with the highest mean Garrett score was identified as the most significant preference among the consumers. For instance, a percentage position of 4.55% corresponds to a Garrett score of 83 for the first rank, 13.64% corresponds to a score of 72 for the second rank, and so forth, up to 95.45%. This yields a score of 17 for the eleventh rank, which can be seen in **Table 3**, the Garrett score table formed in the study.

Table 3: *Garrett score table in the study*

Rank	Percentage (%)	Garrett Score
1	4.55	83
2	13.64	72
3	22.73	65
4	31.82	60
5	40.91	54
6	50.00	50
7	59.09	45
8	68.18	41
9	77.27	35
10	86.36	29
11	95.45	17

4. RESULTS AND DISCUSSION

This section provides the demographic profile based on the 417 respondents. The ranked preferences were analysed using the Garret Ranking Analysis.

4.1 Demographic Profile

A total of 417 respondents participated in this questionnaire, of whom 214 were EV users and 203 were non-EV users. The demographic profile is shown in **Table 4** as follows. These characteristics aid in interpreting the analysis.

Table 4: Respondent demographic profile

	Total	Percentage (%)
Gender		
Male	211	50.6
Female	206	49.4
Total	417	100
Age		
18-29 years	99	23.7
30-40 years	134	32.1
41-50 years	98	23.5
50 years and above	86	20.6
Total	417	100
Race		
Malay	361	87.3
Chinese	33	7.9
Indian	20	5.0
Total	417	100
Educational Level		
Degree	303	72.7
STPM/Diploma	60	14.4
SPM and below	41	9.8
Postgraduate	13	3.1
Total	417	100
Occupation		
Private	255	61.1
Government	97	23.3
Self-employed	37	8.9
Unemployed	20	4.8
Student	8	1.9
Total	417	100
Monthly Income (RM)		
1001 - 3000	89	21.3
3001 - 5000	172	41.2
5001 - 10,000	106	25.4
> 10,000	50	12.0
Total	417	100
Area		
Urban	242	58.0
Suburban	175	42.0
Total	417	100
Type Of EV		
Un specified EV	109	51.0
BEV	42	10.1
HEV	37	8.9
PHEV	26	6.2
Total	214	100

As shown in **Table 4**, the 417 respondents were divided into 214 EV users and 203 non-EV users. The gender aspect indicates that 211 respondents (50.6%) were men and 206 (49.4%) were women. The largest group of respondents was aged 30-40 (32.1%), followed by those aged 18-29 (23.7%), 41-50 (23.5%), and >50 (20.6%). By race, most were Malay (87.3%), followed by Chinese

(7.9%), while a minority were Indian (5.0%). In terms of education, degree holders represented 72.7%, after which came those with STPM/Diploma (14.4%), SPM and below (9.8%), and postgraduates (3.1%). Next, the private sector dominated in terms of work (61.1%), followed by government staff (23.3%), the self-employed (8.9%), the unemployed (4.8%), and students (1.9%). Household income clustered at RM3,001–5,000 (41.2%), with RM5,001–10,000 (25.4%), RM1,001–3,000 (21.3%), and > RM10,000 (12.0%) being the other income categories. Most respondents lived in urban areas (58.0%), while 42.0% were recorded as living in suburban areas.

4.2 Ranking Method

The Garrett Ranking Analysis was employed to identify and prioritise the most preferred factors influencing consumers' electric vehicle choices among the respondents. **Table 5** shows the results of the Garrett Ranking Analysis, which identified the key factors shaping consumer preferences for EVs. Meanwhile, **Figure 1** depicts the ranking results visually, demonstrating the significance of each factor. The process involved computing the percentage position for each assigned rank.

The total score was obtained by multiplying the Garrett score of each rank by the number of respondents. Then, the score was divided by the total number of respondents. Taking the price factor, for instance, the combined score for this was 20,855, which was then divided by the number of respondents (417), producing a value of 50.01%. Overall, according to the findings, consumers prioritised reduced CO_2 emissions as the primary factor to consider with regard to EV use. This was ranked first, receiving the highest combined score of 21,985 (52.72%). Scoring 21,155 (50.73%), vehicle design was the second most important factor, while charging infrastructure was ranked third with a score of 20,994 (50.34%).

Table 5: *Garrett ranking of EV preferences factors (N=417)*

Factor	1	2	3	4	5	6	7	8	9	10	11	Total Score	Percentage (%)	Rank
Reduce CO_2	37	50	49	42	36	48	35	32	29	30	29	21,985	52.72	1
Design	38	39	51	37	34	32	36	34	40	43	33	21,155	50.73	2
Infrastructure	47	30	28	38	44	45	35	38	39	39	34	20,994	50.34	3
Vehicle performance	36	44	49	32	34	37	37	32	34	38	44	20,964	50.27	4
Safety features	36	40	36	41	43	37	26	40	42	43	33	20,928	50.18	5
Incentives	48	26	34	35	46	34	44	37	43	31	39	20,914	50.15	6
Price	39	33	34	41	39	39	42	33	48	35	34	20,855	50.01	7
Range Anxiety	37	38	46	39	28	38	40	32	34	40	45	20,776	49.82	8
Charging	36	47	22	41	32	37	45	48	33	29	47	20,628	49.46	9
Maintenance Cost	32	44	32	39	32	37	42	37	35	44	43	20,461	49.06	10
Cost Saving	31	26	36	32	49	33	35	54	40	45	36	20,107	48.21	11

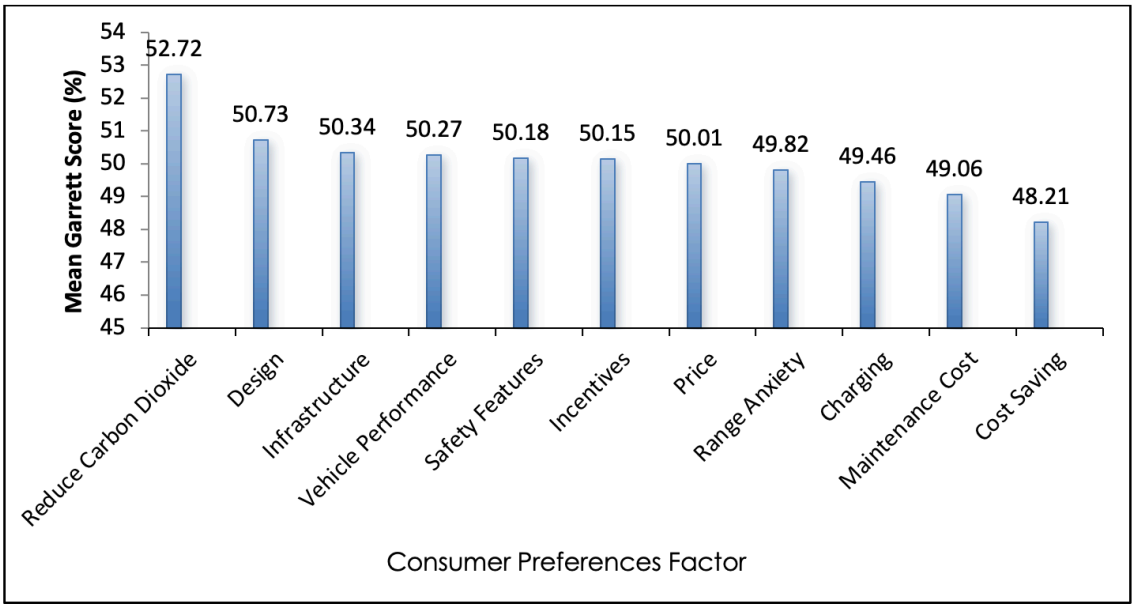

Figure 1: *Ranked factors influencing consumer preferences for EVs*

To guarantee ecological sustainability in the long term, Sovacool et al. (2018) advocated alignment between transport choices and environmental awareness, especially CO_2 emission-reduction projects. Meanwhile, scoring a total of 20,107 (48.21%), cost savings was the factor ranked last. This finding supports the work of Li et al. (2017), who noted that policies and financial savings related to EV are still insufficiently understood by the general public, leading to lower prioritisation of this attribute. Although EVs generally incur lower long-term operating costs, the findings show that respondents did not view cost efficiency as a key factor in their decisions. This suggests that many consumers remain unaware of the real total cost of ownership (TCO) benefits. Uncertainty about electricity prices, resale value, and the cost of replacing batteries may make EVs seem less affordable. Misunderstandings about battery lifespan and maintenance further reduce interest in cost savings (Wang et al., 2023; Rahman et al., 2023).

4.3 Environmental Values on EV Preferences

The domain of growing awareness of CO_2 emissions reduction should be prioritised for environmental sustainability. Sovacool et al. (2018) showed that consumers should be aware that transportation choices are essential to the global effort to reduce CO_2 emissions, aligning with the Low-Carbon Mobility Blueprint. In Malaysia, air pollution topics are major concerns, prompting the government to commit to the Paris Agreement by increasing green mobility. This result aligns with the findings of Wong et al. (2023), who also identified environmental concerns, cost, infrastructure, and social influence as significant determinants of EV acceptance.

4.4 Design and Innovation of EV preferences

Today, consumers are highly particular about EV design, and they show great interest in innovation. Rather than seeing EVs just as a mere form of transport, many consumers have started viewing them as modern and stylish in order to match their lifestyle choices. Zhao et al. (2024) observed similar trends, whereby design and technological appeal may influence consumer preferences for EVs. In Malaysia, consumers are more attracted by advanced technology and premium aesthetics. The presence in the local market of branded EVs such as Tesla, BYD, and Hyundai Ioniq reinforces this perception, as these models are often positioned as technologically innovative (Wong et al., 2023). Besides advanced functionality, EV design represents a sense of a modern lifestyle, with individuality and innovative designs encouraging consumers to see EVs as stylish and advanced products rather than just transport tools.

4.5 Infrastructure

While not ranked as the leading concern, the availability of charging infrastructure remains an important factor that shapes consumer EV preferences. Convenience in using EVs largely depends on the number of available chargers compared to the total number of vehicles on the road. The charger-to-vehicle ratio in Malaysia remains below worldwide standards, so drivers tend not to be confident about making lengthy journeys. Moreover, user experience is shaped by reliable, easily accessible, fast-charging stations. Users frequently experience range anxiety due to the unevenness with which chargers are distributed, particularly away from large cities (Phutong et al., 2024). Charger networks need to be expanded, and operational consistency must be ensured if convenience is to be improved and more widespread EV use is to be encouraged (Anegawa, 2010; Kissling et al., 2024). Data from the International Energy Agency (IEA, 2023) indicate that countries where EV numbers have risen are more likely to have provided physical infrastructure and robust policy support. These points illustrate that consumers with the motivation to make the EV transition continue to depend on systems of support in order to gain reassurance about using such vehicles. EV usage will not become widespread if the infrastructure is inadequate.

Research has revealed that comparable obstacles affect Thailand; despite supportive official initiatives in the country, user confidence is hindered by poor access to charging and limited, reliable maintenance. In other ASEAN nations like Indonesia and Vietnam, similar findings have been reported. This indicates that the region's consumers have corresponding concerns in terms of cost perceptions, reliable charging, and usability over long distances (Wang et al., 2023; Li et al., 2023). Similar experiences across the Southeast Asia region indicate that in the region's emerging markets, the most crucial features driving EV adoption are still infrastructural preparedness and consumer trust.

5. CONCLUSION

In the current study, the Garrett Ranking Analysis was used to identify key factors that influence consumer EV-related preferences in Malaysia. According to the findings, consumers ranked the three major determinants as environmental concerns, vehicle design, and charging infrastructure. In contrast, the lowest-ranked factors were charging time, maintenance cost, and cost saving. In terms of the environment, consumers would gain advantages like better air quality and lower CO_2 emissions. Greater public awareness is needed of the ways that using EVs contributes to the national targets in the Low-Carbon Mobility Blueprint 2021-2030 and National Energy Transition Roadmap (NETR), which would improve pro-environmental buying behaviours among consumers. In regard to design, enhancing Malaysian acceptance of EVs means that the design and interface of these vehicles must be adapted to match the tastes of local consumers. Driving can be made more comfortable, and the sensation

of safety can be enhanced by adjusting the styling, cabin layout, and features of the human–machine interface (HMI). Trust among users can be strengthened by communicating effectively on safety aspects like reliability, protection for batteries, and systems for driver assistance. From the vehicle manufacturing angle, these findings suggest that to align with local consumer preferences, EV product offerings should be enhanced, particularly exterior and interior design, smart technology, and safety features.

Since infrastructure development remains the cornerstone of EVs, developing and expanding charging networks along major highways and in major cities will be a key practical task and reduce range anxiety. Furthermore, local authorities and utility companies could expand the availability of the supporting infrastructure. Strategic placement of fast-charging stations at shopping malls, in commercial areas, along highways, and in public transport hubs should be prioritised. The development of mobile applications to help users locate nearby charging stations might also improve convenience and usability.

This study could also provide valuable insights to the government, automotive industry stakeholders, and infrastructure providers. For policymakers, the results suggest the need to introduce more attractive policy incentives, such as tax rebates, import duty exemptions, and price subsidies, as well as additional benefits like toll waivers or free parking. These initiatives may encourage greater EV adoption among consumers. The transition to EVs contributes to lowering fossil fuel dependency, a major driver of climate change. From a public health standpoint, improved air quality resulting from reduced vehicular emissions will enhance the quality of life for residents, particularly urban populations that are frequently exposed to traffic-related pollution.

5.1 Limitations and Future Research

Although this study provides insights into consumer preferences for EVs, several limitations should be acknowledged. The sample focused only on respondents from Kuala Lumpur and Selangor, who may not fully represent the views of consumers in other parts of Malaysia. As the research was conducted using a cross-sectional design, it captured perceptions at a specific moment rather than reflecting changes over time. Moreover, the study included no analysis of actual purchasing behaviour, limiting the understanding of real-world decision patterns. Future research could apply approaches such as conjoint analysis or Best Worst Scaling to measure trade-offs between EV attributes with greater precision. Moreover, to examine the evolution of consumer preferences alongside infrastructural development and market expansion, the author recommends longitudinal tracking and segmentation analysis.

ACKNOWLEDGEMENT

This research was supported by the Ministry of Higher Education (MOHE) Malaysia through the Fundamental Research Grant Scheme (FRGS/1/2023/SS06/UMT/02/5)

REFERENCES

Ahmad, K., Ismail, F., & Chan, S. W. (2024). Moving towards sustainable purchase behaviour: Determinants of consumers' acceptance of electric vehicles in Malaysia. *paperASIA, 40*(4b), 143–154. https://doi.org/10.59953/paperasia.v40i4b.207

Ahmat, N., Nawawi, M. N., Mat Alipiah, R., Saputra, J., & Sukemi, M. N. (2024). Reducing carbon emissions through EVs preference: Evidence from suburban East Coast Malaysia. *International Journal of Sustainable Development and Planning, 20*(8), 3533–3540. https://doi.org/10.18280/ijsdp.200833

Anegawa, T. (2010). Characteristics of CHAdeMO quick charging system. *World Electric Vehicle Journal, 4*(4), 818–822. https://doi.org/10.3390/wevj4040818

Chu, S., Lu, C., & Xiao, W. (2022). Factors influencing electric vehicle adoption in emerging economies: A review. *Sustainable Cities and Society, 82*, Article 103883. https://doi.org/10.1016/j.scs.2022.103883

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Lawrence Erlbaum Associates.

EV Connection. (2024). *EV charging station network and utilisation data*. https://www.evconnection.com.my/

EVBoosters. (2023, June 1). *Charging speed influencing consumer adoption of EVs*. Editorial Board EVBoosters. https://evboosters.com/ev-charging-news/charging-speed-influencing-consumer-adoption-of-evs/

Garrett, H. E., & Woodworth, R. S. (1969). *Statistics in psychology and education* (6th ed.). David McKay Company.

Gunawan, I., Wicaksono, A., & Setiawan, B. (2022). Evaluating performance perception of electric vehicles: Evidence from Indonesian consumers. *Energy Reports, 8*, 118–125.https://doi.org/10.1016/j.energyrep.2021.12.111

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2021). *A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)* (3rd ed.). Sage Publications. https://doi.org/10.1007/978-3-030-80519-7

Han, L., & Liu, P. (2019). Factors influencing consumer adoption of electric vehicles in China. *Transportation Research Part D: Transport and Environment, 67*, 733–745. https://doi.org/10.1016/j.trd.2019.01.001

Hidrue, M. K., Parsons, G. R., Kempton, W., & Gardner, M. P. (2011). Willingness to pay for electric vehicles and their attributes. *Resource and Energy Economics, 33*(3), 686–705. https://doi.

org/10.1016/j.reseneeco.2011.02.002

International Energy Agency (IEA). (2023). *Global EV Outlook 2023: Catching up with climate ambitions*. IEA. https://www.iea.org/reports/global-ev-outlook-2023

Kissling, C., Stute, M., & Wietschel, M. (2024). Public charging infrastructure and user behaviour in the transition to electric mobility: Evidence from emerging EV markets. *Energy Policy, 186*, Article 113598. https://doi.org/10.1016/j.enpol.2023.113833.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Li, W., Long, R., & Chen, H. (2017). Consumers' evaluation of national new energy vehicle policy in China: An analysis based on a four paradigm model. *Energy Policy, 109*, 609–620. https://doi.org/10.1016/j.enpol.2017.07.025

Loganathan, R., Jeyakumar, A., & Kumar, M. (2021). A study on consumer preference using Garrett Ranking analysis in green marketing. *Journal of Green Research, 10*(2), 45–51. https://doi.org/10.2478/orga-2021-0013

Logtenberg, R., Ploeg, J., & Farah, H. (2018). Potential societal impacts of automated vehicles and the role of HMI: A literature review. *Transportation Research Part F: Traffic Psychology and Behaviour, 58*, 842–854. https://doi.org/10.1016/j.trf.2018.06.022

Louviere, J. J., Hensher, D. A., & Swait, J. D. (2010). *Stated choice methods: Analysis and applications*. Cambridge University Press. https://doi.org/10.1017/CBO9780511753831

Malaysia Automotive, Robotics and IoT Institute. (2023). *Electric vehicle industry update report*. MARii. https://www.marii.my/

Malaysian Automotive Association. (2025, July 17). *EV sales up 91.4% in 2025*. Paultan. https://paultan.org/2025/07/17/maa-ev-sales-data-1h-2025/

Martin, E., Shaheen, S., & Lidicker, J. (2009). Impact of car sharing on household vehicle holdings. *Transportation Research Record: Journal of the Transportation Research Board, 2110*(1), 150–158.

Ministry of Economy. (2023). *National Energy Transition Roadmap (NETR)*. Government of Malaysia. https://www.economy.gov.my/

Ministry of Finance Malaysia. (2023). *Malaysia Budget 2024*. Government of Malaysia. https://budget.mof.gov.my/

Ministry of Investment, Trade and Industry. (2024). *Malaysia Electric Mobility Blueprint 2025*. Putrajaya: MITI.

Ministry of Transport Malaysia (MOT). (2023). *Low Carbon Mobility Blueprint 2021–2030*. Putrajaya: Government of Malaysia.

Nazari, M., Haghani, M., & Hamedi, M. (2023). Modelling range anxiety in electric vehicle adoption: A system dynamics approach. *Energy Reports, 9*, 543–556.

Oliveira, L., Moura, P., & de Almeida, A. T. (2015). Electric vehicles in Portugal: Market analysis and charging infrastructure. *Energy Policy, 80*, 107–120. https://doi.org/10.1016/j.enpol.2014.12.016

Pandey, D., & Verma, M. R. (2019). Application of Garrett ranking technique for factors influencing farmers' decision making. *International Journal of Current Microbiology and Applied Sciences, 8*(3),1458–146.

Phutong, W., Thongkumkoon, T., & Laopimol, J. (2024). Identifying factors influencing electric vehicle adoption in an emerging market: The case of Thailand. *Journal of Cleaner Transportation, 4*(1), 88–99. https://doi.org/10.1016/j.trip.2024.101229

PlugShare. (2024). *Electric vehicle charging station map and user data*. https://www.plugshare.com/

Rahman, M. M., Tan, C. W., & Yong, T. S. (2023). Carbon emissions from the Malaysian transport sector: An overview. *Environmental Sustainability Reports, 6*(1), 24–33.

Rezaei, J. (2015). Best-worst multi-criteria decision-making method. *Omega, 53*,4 Article 957. https://doi.org/10/1016/j.omega.2014.11.009

Rezvani, Z., Jansson, J., & Bodin, J. (2015). Advances in consumer electric vehicle adoption research: A review and research agenda. *Transportation Research PartD: Transport and Environment, 34*,122–136. https://doi.org//10.1016/j.trd.2014.10.010

Saaty, T. L. (2008). Decision making with the analytic hierarchy process. *International Journal of Services Sciences, 1*(1), 83–98. https://doi.org/10.1504/IJSS.2008.017590

Sierzchula, W., Bakker, S., Maat, K., & van Wee, B. (2014). The influence of financial incentives and other socio-economic factors on electric vehicle adoption. *Energy Policy, 68*, 183–194. https://doi.org/10.1016/j.enpol.2014.01.043

Sovacool, B. K., Axsen, J., & Kempton, W. (2018). The future promise of electric vehicles: A critical review of literature and policy. *Energy Policy, 113*, 74–84. https://doi.org/10.1016/j.enpol.2017.10.036

U.S. Department of Energy. (2021). *Electric vehicle maintenance benefits*. U.S. Office of Energy Efficiency & Renewable Energy. https://www.energy.gov/eere/electricvehicles/charging-home

Wang, J., Huang, C., He, D., & Tu, R. (2023, September). Range anxiety among battery electric vehicle users: Both distance and waiting time matter. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 67*(1), 1309–1315.

Wong, L. S., Tan, K. L., & Ooi, K. B. (2023). Determinants of electric vehicle adoption intention in Malaysia: Environmental concern, infrastructure, cost, and social influence perspectives. *Sustainable Energy Technologies and Assessments, 56*, Article 103247.

https://doi.org/10.1016/j.seta.2023.103247
Zhao, H., Furuoka, F., Rasiah, R. A., & Shen, E. (2024). Consumers' purchase intention toward electric vehicles from the perspective of perceived green value: An empirical survey from China. *World Electric Vehicle Journal, 15*(6), Article 267. https://doi.org/10.3390/wevj15060267