Green Vehicles and Public Perception: a Southeast Asian Perspective

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Understanding public perception of eco-friendly transportation is critical for global climate change mitigation. This study investigates the factors influencing public perception of green vehicles in Malaysia and Thailand. A quantitative survey (n=140) targeting green vehicle and non-green vehicle owners in major cities of both countries was surveyed. Convenience sampling and regression analysis revealed a significant relationship between knowledge of green transportation, awareness of green transportation, green transportation costs and green transportation perception. These findings highlight the importance of addressing knowledge gaps and cost concerns to encourage green transportation adoption among Southeast Asian vehicle users. This information can guide policymakers and marketers in developing strategies to promote sustainable travel options. Future research could explore additional factors or expand geographically to gain a more comprehensive understanding.

1. Introduction

The transportation sector is a major contributor to global air and noise pollution, posing significant health and environmental threats (He and Li, 2022). In response, the development and adoption of green vehicles, encompassing electric cars, hybrids and other low-emission technologies, have become a crucial strategy for achieving sustainable transportation (IEA, 2023). While extensive research explores the environmental benefits of green transportation (He and Li, 2022), a critical knowledge gap exists regarding public awareness of these benefits in Southeast Asia (Hossain et al., 2022). Studies suggest limited public understanding of green transportation's life-cycle costs, which may include potential maintenance savings compared to traditional internal combustion engine vehicles (ICEVs) (Hamzah et al., 2021). Research highlights cost parity as a key challenge, with some Southeast Asian markets struggling to achieve price competitiveness with ICEVs due to varying levels of development (IEA, 2023). This knowledge gap is particularly concerning in Southeast Asia, the rapid economic growth, urbanization and rising car ownership in Southeast Asia creates a unique socio-economic and cultural landscape (Kafi et al., 2024). This unique confluence of economic growth, urbanization and car ownership in Southeast Asia likely fosters public perceptions of green vehicles that are distinct from those observed in global consumer perception research.

This study aims to bridge the critical knowledge gap by investigating public perceptions of green vehicles in Malaysia and Thailand through a quantitative survey. Using regression analysis, the survey will explore how factors such as awareness of green transportation options, technology knowledge, environmental consciousness and perceived cost influence public perception. By identifying these influential factors and analyzing regional trends, this research can provide valuable insights for stakeholders seeking to accelerate the transition towards sustainable transportation in Southeast Asia.

2. Literature review and hypothesis development

Malaysia and Thailand boast some of the highest private car ownership rates in Southeast Asia, following Brunei. According to the ASEANStats Database (2017), these countries have vehicle ownership rates of 897 and 548 per 1,000 people, with a steady annual increase averaging 8.6 %. Recognizing the environmental impact of predominantly internal combustion engine (ICE) vehicles, Malaysia and Thailand began exploring green technology solutions as early as 1990, introducing hybrid cars that combine electric power with traditional gasoline engines. Data from the Energy Commission Malaysia (2014) shows an average growth rate of 5.7 %, with the transportation sector accounting for roughly 39 % of the country's final energy consumption. The average annual growth rate of newly registered private vehicles stood at 8.7 % (Sang and Bekhet, 2015). Despite these challenges, there are promising solutions. With over 0.5×10^6 new vehicles sold in Malaysia annually since 2010, fuel economy standards have emerged as a potential tool (Joshi, 2018). These standards mandate yearly improvements in the energy efficiency of both ICEVs and hybrid electric vehicles (HEVs). The transport sector heavily relies on limited and non-renewable resources, leading to detrimental environmental impacts (International Energy Agency, 2023). It is a major contributor to global climate change, releasing greenhouse gases like CO_2 (carbon dioxide) and air pollutants (Takam, et al., 2023) like NOx (nitrogen oxides) (European Environment Agency, 2023). While HEVs and EVs (Electric Vehicles) are hailed as solutions for climate change, their uptake in Southeast Asia, notably Malaysia and Thailand, faces hurdles, primarily due to their high upfront costs, driven by expensive battery technology (Bloomberg New Energy Finance, 2020). Both countries require substantial investments in charging infrastructure and grid development to support widespread electric mobility. The rapid growth of private transportation exacerbates environmental challenges, with cities like Bangkok and Kuala Lumpur experiencing severe air pollution and congestion (Joshi, 2018).

2.1 Knowledge of green transportation

Several studies have explored consumer knowledge and motivations regarding green cars and ICE vehicles. A study in Colombo, Sri Lanka, found that a majority (54 %) of respondents had poor knowledge about green cars (Ponnamperuma, 2017). A survey of Swiss buyers revealed that cost savings are not the primary motivator for purchasing hybrid cars, with lower fuel consumption and higher efficiency being the main drivers (Weber, 2019). Peters et al. (2015) suggest that financial incentives can influence consumers' car choices, while Teisl et al. (2008) develop a model exploring the relationship between individual characteristics, motivations and the content of information policies. Studies have shown that higher education positively impacts stated choices for hybrid vehicles, potentially due to increased knowledge of quality, cost, environmental benefits and purchase intention concepts grounded in prospect theory (Potoglou and Kanaroglou, 2007). This aligns with similar research on understanding green car purchase intention among Malaysian consumers (Lim et al., 2019). Promoting the adoption of green technologies, such as electric and hybrid vehicles, is crucial for environmental protection. Equipping sales teams with the knowledge to explain the features and benefits of these advanced vehicles is essential for their success in a rapidly evolving market

2.2 Awareness of green transportation

Numerous studies have explored the relationship between environmental awareness and electric vehicle (EV) adoption. Research suggests that environmental awareness directly influences the purchase intention of non-EV users, but its impact on post-purchase satisfaction of EV users might be indirect. This aligns with discussions in Transportation Research and Transport and Environment, highlighting the significance of green technology in transportation studies (Okada et al., 2019). Consumer concerns and knowledge gaps remain significant barriers to widespread EV adoption. While there is growing public support for low-emission vehicles, a recent study by the Institute of the Motor Industry (IMI) in the UK revealed that nearly a third of respondents would never consider buying an EV (Institute of the Motor Industry, 2024). Public awareness and exposure to EVs in Malaysia and Thailand remain relatively low compared to other countries, impacting their purchase and sales figures (Tsai et al., 2024). These findings highlight the need for targeted interventions to address consumer concerns and improve public understanding of EVs. Educating the public about environmental issues, vehicle engine technologies and the latest advancements in green transportation can be achieved through government-led programs (Peters et al., 2015).

2.3 Costs of green transportation

The initial purchase price of electric and hybrid vehicles (EVs and HEVs) is often higher than conventional gasoline cars due to their advanced technology. Concerns exist regarding the resale value of used EVs and HEVs due to limited market penetration and rapid advancements in technology (International Energy Agency, 2023). Moreover, concerns about "range anxiety" limited driving range and availability of charging infrastructure for EVs – can deter potential buyers (Electric Power Research Institute, 2019). Natural gas vehicles (NGVs)

present a potentially cost-effective alternative. Compressed natural gas (CNG) and liquefied natural gas (LNG) are cleaner-burning options than traditional gasoline or diesel fuels, with lower greenhouse gas emissions (Thiruvengadam et al., 2018). According to the International Gas Union (International Gas Union, 2024), there were over 30×10^6 NGVs globally in 2022, with projections for continued growth, suggesting a potentially more established infrastructure compared to some alternative fuel options. Limitations exist, including the need for specialized refueling stations and potential concerns regarding methane emissions from NGVs, requiring further research (UN, 2021). Other studies suggest that diesel fuel mixtures can help reduce emissions (Chuah et al., 2016) of smoke, carbon monoxide (CO), particulate matter and hydrocarbons (HC) (Bozbas, 2008). Ownership costs for EVs are generally higher than those of ICE vehicles (Prapinit et al., 2019) on logistics in Northeast Thailand highlights the role of knowledge in influencing transportation costs. While their study focused on knowledge gaps, it indirectly suggests that a lack of understanding about green technologies could potentially be a cost barrier.

Extant literature comprehensively explores various dimensions of green practices related to EVs. A critical research gap persists regarding the empirical validation of specific EV attributes that directly influence user perception of green transportation. This includes factors like knowledge of green transportation, user awareness and the cost of green transportation in Figure 1. This study aims to bridge this gap by proposing the following three hypotheses that factors influencing green EV usage intentions significantly impact user perception of green transportation. Accordingly, posit the following hypotheses:

- H1: Knowledge has a significant positive relationship with green transportation.
- H2: Awareness has a significant positive relationship with green transportation.
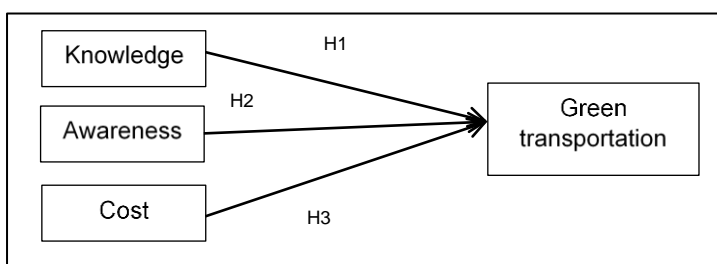- H3: Cost has a significant positive relationship with green transportation.

Figure 1: The framework for the study

3. Methodology

A quantitative approach investigates factors influencing EV usage perceptions in Malaysia and Thailand. A self-administered survey, developed through literature review and expert consultation for content validity, targets a diverse sample in major, high-mobility cities (Bangkok, Had Yai, Kuala Lumpur, Penang) across both countries. The two-part survey (n=140) gathers demographic information (Section A) and measures key EV perception predictors using a 5-point Likert scale (Section B). Data analysis using SPSS version 33 will employ descriptive statistics to summarize responses, correlation analysis to assess relationships between variables and finally, multiple regression analysis to identify the relative influence of these factors on overall EV usage perceptions.

4. Results

Table 1 details the demographics of the 140 participants gathered using convenience sampling from Thailand and Malaysia, both Southeast Asian countries. The sample placed slightly male (60 %), with the largest age group being 46 and above (36 %). Racially, the majority identified as Malay/Thailand (Muslim) (46 %), followed by Chinese/Thailand (43 %) and Indian (11 %). Most respondents were married (66 %) and nearly 39 % owned non-green transportation. In terms of income, the highest earners (44 %) reported monthly income exceeding RM 4000 (or the equivalent Thai Baht).

This section explores the relationships between independent variables and the dependent variable using descriptive statistics. Survey participants rated various factors impacting their perception of green transportation. Pearson's correlation analysis was employed to assess the correlation between the independent variables' influence and the dependent variable. Table 2 summarizes the descriptive statistics of the variables. The mean score for green transportation perception was 3.83 (on a scale of 1 to 5), indicating a moderate level of perception. Similarly, the mean scores for transportation knowledge (3.91) slightly higher than awareness (3.80) and cost perception (3.79) levels on the same scale. The Cronbach's α for the overall scale of each factor was

within 0.85-0.88, suggesting a very strong consistency among the items for each factor (Pllant, 2011). Table 2 reveals positive associations between all the studied variables. The regression analysis provided robust support for the hypothesized positive influence of knowledge (β = .418, p <.001) and cost (β = -.328, p < .001) on green transportation usage perceptions has negative association. The strongest association was observed between green transportation and awareness (r = .852, p < .01), signifying a robust positive relationship (Hair et al., 2010). Individuals with greater green transportation knowledge are more likely to adopt these options. Conversely to expectations, cost perception negatively impacted usage intentions, suggesting knowledge, while important, may not directly influence overall perception.

Table 1: Demographic profile of the Respondents (n=140)

Demographic	Category	Frequency	Percentage (%)
Gender	Male	84	60
	Female	56	40
Age	18-25 y	25	18
	26-35 y	30	21
	36- 45 y	35	25
	46 y and above	50	36
Race	Malay /Thailand (Muslim)	65	46
	Chinese /Thailand	60	43
	Indian /others	15	11
Marital status	Single	48	34
	Married	92	66
Job status	Public, officers and above	45	32
	Owner of green transport	35	25
	Owner of non-green transport	55	39
	Regulatory bodies	5	4
Salary	Below RM 2000 (THB)	34	24
	RM 2000 (THB)-RM 4000(THB)	44	32
	RM 4000(THB) and above	62	44

Table 2: Description Statistics of Variables and Correlation Matrix

Variables	No of items	Mean	Standard deviation	Cronbach's α	Correlation matrix				
					Variables	KN	AW	CS	GT
KN	5	3.91	.85	.88	KN	1.000			
AW	5	3.80	.82	.87	AW	.947**	1.000	1.000	
CS	5	3.79	.84	.86	CS	.877**	.915**		
GT	5	3.83	.83	.85	GT	.936**	.947**	.818**	1.000

*Note: KN-Knowledge; AW-Awareness; CS-Costs; GT-Green Transportation; **. Correlation is significant at the 0.01 level (2-tailed).*

Table 3: Measurement model

Factors	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Hypothesis testing results
	B	Std. Error	β			
Constant	.214	.091		2.357	.020	
KN	.405	.069	.418	5.901	.000	Supported
AW	.857	.085	.852	10.087	.000	Supported
CS	-.324	.056	-.328	-5.798	.000	Supported

Notes: *KN-Knowledge, AW-Awareness, CS- Cost, GT-Green transportation (Dependent variable): R=0.96, Adjusted R2=.93 F=40.89, Significant=0.000*

5. Discussion

The study emphasizes the potential influence of people perceptions and awareness of green transportation (H1). To achieve widespread adoption of sustainable transportation perceptions, a multifaceted approach that incorporates both knowledge-based initiatives and strategies addressing these practical considerations is likely

to be most effective. While user awareness of green perception is a valuable first step, these findings suggest that maximizing user perception requires a comprehensive approach. This means addressing factors beyond awareness, such as psychological barriers, social influences and infrastructure availability (H2). By focusing on a holistic strategy that tackles these additional considerations, a more favorable environment for users to embrace green transportation options can be created. Finally, H3 revealed a negative association between cost perceptions and user perception of green transportation options. This suggests that users who perceive green transportation to be less affordable are more likely to view these options favorably. This finding aligns with previous study, which posits that cost is a primary driver of consumer behavior (Shah and Yang, 2022) further highlight the significant role of affordability in promoting environmentally friendly choices. This study suggests that financial incentives and strategies that reduce the perceived or actual cost of green transportation options can be highly effective in encouraging user adoption.

6. Conclusion

The study focused on Malaysia and Thailand perceptions the significance of knowledge in driving green transportation adoption. This research contributes to the growing body of knowledge surrounding public transportation user behaviour and the adoption of green technologies. In light of these findings, policymakers should prioritize addressing the cost barrier associated with green transportation ownership. This could involve implementing strategies like government subsidies, tax breaks, or financing options to make green vehicles more affordable. Promoting public awareness and knowledge about the environmental benefits of green transportation should be a key component of green initiatives. By tackling cost concerns and fostering understanding, this research suggests a path towards a more sustainable future for public transportation in Malaysia and Thailand. This could have a significant impact on environmental well-being in these regions. While this initial analysis is based on 140 respondents focus only two countries and limit the generalizability of the findings in the entire region. Future research will enhance the model's ability to predict across broader contexts.

Acknowledgements

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