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Assessing Factors Influencing Transportation Choices in Taiwan

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ABSTRACT

This study assesses the factors influencing transportation choices in northern Taiwan using a quantitative approach. A survey of 406 travelers evaluated three major transportation modes—public transportation, private cars, and private scooters—across dimensions of practicality, convenience, cost, environmental impact, and safety. Results indicated significant differences among the modes, with public transportation being rated highest in practicality, safety, and environmental friendliness, and lowest in cost. Private scooters were found to be the most convenient, though they had higher environmental impact ratings compared to public transportation. Private cars were rated the lowest in cost-effectiveness and environmental impact but offered significant comfort and practicality. The study highlights the need for promoting public transportation and cleaner alternatives to address environmental and cost concerns. Recommendations include improving public transport infrastructure for greater convenience and safety and encouraging eco-friendly options like electric vehicles to address environmental concerns.

Keywords: Transportation choices, Transportation mode, Environmental impact, Satisfaction

INTRODUCTION

Traffic safety is a global concern, with various strategies implemented worldwide to mitigate road accidents and fatalities. Vision Zero, introduced by the Swedish Parliament in 1997, is one of the most influential approaches, aiming for zero fatalities or serious injuries within the road transportation system. This initiative underscores the responsibility of system designers to ensure road user safety, prompting car manufacturers and consumers to prioritize safety (Fahlquist, 2006). Despite such advancements, road traffic injuries remain a leading cause of death globally, with organizations such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) highlighting the preventable nature of these incidents (WHO, 2015; CDC, 2011). Road traffic crashes, resulting from a variety of factors, are not only a highway safety issue but also a significant public health concern. Annually, over a million lives are lost to transportation accidents worldwide (WHO, 2018). The economic impact is equally staggering, with motor vehicle crashes in the United States costing over $230 billion in 2000 (Blincoe et al., 2002). Given these figures, setting and enforcing vehicle safety standards and implementing research-based interventions are crucial

to enhancing road safety. Effective interventions have demonstrated their impact. For instance, safety belt usage in the United States increased from 75% to 79% in 2003, while other measures such as child safety seat laws, seat belt enforcement, and sobriety checkpoints have contributed to significant declines in traffic fatalities globally (Evans, 2003; Solomon et al., 2003; NHTSA, 2001). These successes suggest that prioritizing road safety on a global scale could lead to even greater reductions in fatalities.

While global initiatives like Vision Zero have improved safety standards, Taiwan faces unique challenges in addressing transportation safety. Taiwan's dense urban environments and heavy reliance on private vehicles and scooters create a complex traffic landscape. This dependence on private transportation presents significant obstacles to improving overall traffic safety, making it essential to understand the factors influencing transportation choices. Although Taiwan has implemented policies to enhance road safety and promote public transportation, such as stricter helmet laws and investments in public transit infrastructure, these efforts have not yet significantly shifted transportation habits. Public transportation, which typically has lower fatality rates per mile compared to private vehicles, remains underutilized. The preference for private vehicles, especially scooters, persists due to their perceived convenience, speed, and affordability, particularly in urban areas. In non-urban regions, where public transportation options are less accessible, private transportation remains a necessity.

Recent investments in Taiwan's public transportation infrastructure, including metro system expansions and bike-sharing programs, have been substantial. The government has also introduced various initiatives to promote public transport usage, such as subsidized fares, increased service frequency, and enhanced infrastructure. A key component of this effort is the integration of services, such as the EasyCard and iPASS, which streamline payments across multiple modes of transportation. These systems enable seamless transfers between Taiwan Railways (TRA), High-Speed Rail (THSR), metro, buses, and bike-sharing services, minimizing the need for cash transactions and expediting fare payments. In addition, to further encourage public transport adoption, the government introduced an integrated commuter pass, allowing unlimited travel across TRA, metro, buses, and bike-sharing services at a fixed cost, making it more attractive to users. Additionally, apps like Taiwan Railway Info and Taiwan Bus Info provide real-time information, improving accessibility and convenience for travelers before and during their trips.

Despite these efforts, the dominance of private motor vehicle use persists. Research indicates that many Taiwanese still perceive public transportation as less efficient and convenient compared to private vehicles (Zhou et al., 2018). This perception is especially common in urban areas, where traffic congestion and limited parking make scooters and private cars appear more practical for daily commutes. Moreover, public transportation in Taiwan continues to face challenges such as overcrowding, limited rural coverage, and inconsistent scheduling (Jiang et al., 2019). As a result, private vehicles remain the preferred choice for many, particularly younger generations

and working professionals who prioritize time efficiency and flexibility. According to a 2022 survey, the market share of public transportation decreased to 14.3%, down from 16.0% in 2020, while non-motorized transportation options, such as walking and cycling, reached a record high of 13.4%. These figures highlight a growing interest in non-motorized transportation, but they also underscore the ongoing struggles public transportation faces in attracting a broader user base.

Understanding the factors influencing transportation choices in Taiwan is crucial for enhancing road safety and addressing transportation challenges. This study aims to analyze the subjective perceptions and evaluations of Taiwanese travelers regarding three major transportation modes: private cars, public transportation, and private scooters. The research will use a detailed quantitative questionnaire survey to collect and assess user feedback on these transportation modes, focusing on practicality, convenience, cost, environmental impact, safety, and time efficiency. By examining these factors, the study seeks to uncover the reasons behind travelers' preferences and satisfaction levels. The goal is to provide insights into how different factors influence transportation choices in Taiwan, which can support further research and discussions on improving transportation systems and safety.

METHODS

To investigate the factors influencing transportation choices in Taiwan, a quantitative research approach was employed. The study focuses on collecting and analyzing subjective evaluations of three major transportation modes: private cars, private scooters, and public transportation. This method was selected to gain deeper insights into travelers' perceptions and experiences with these modes. A convenience sampling technique was used to recruit Taiwanese travelers for participation in the study. Participants were provided with a QR code that directed them to an online questionnaire, designed using Google Forms. The survey used a 7-point Likert scale to evaluate six key dimensions: practicality, convenience, cost, environmental impact, safety, and time efficiency. Respondents were asked to rate their satisfaction levels with each transportation mode based on these six factors.

- Practicality refers to the ease and feasibility with which each transportation mode meets the daily commuting needs of individuals. Each mode is evaluated based on how well it suits the urban environment in Taiwan, considering the factors that impact daily travel, such as flexibility and accessibility.
- Convenience measures how easily travelers can access and utilize various transportation options. This factor evaluates aspects such as waiting times, proximity to transport stops, and the comfort level of the different modes of transport. The study recognizes that travelers may prioritize convenience differently based on personal experiences and urban conditions.
- Cost is a significant factor in transportation decisions, especially for younger individuals or budget-conscious travelers. The financial cost of

using private vehicles or scooters, including expenses for fuel, parking, and maintenance, is compared to the generally lower costs of public transportation, which is often subsidized by the government.

- Environmental impact is an increasingly important consideration due to the growing focus on sustainability and reducing pollution. The study considers how travelers perceive the environmental consequences of different transportation modes, including the potential benefits of eco-friendly alternatives, such as electric scooters and public transport options.
- Safety evaluates the degree to which each transportation mode poses a risk to individuals, focusing on injury and fatality rates, along with perceived safety concerns. Although private vehicles and scooters may have higher accident rates, public transportation also faces its own safety challenges. This dimension aims to capture how safety is perceived across modes, considering factors such as vehicle maintenance, road conditions, and security measures.
- Time efficiency considers the amount of time required to travel between locations, with a focus on how delays, congestion, and waiting times affect the perceived efficiency of each transportation mode. While private vehicles and scooters may offer faster travel times in certain situations, public transportation may be subject to delays, especially during peak hours.

RESULTS

In this study, a total of 406 valid questionnaires were collected from travelers residing in northern Taiwan, comprising 232 males (57.1%) and 174 females (42.9%). The age distribution of the sample ranged from 18 to over 71 years, with most respondents falling between 20 and 50 years old. The largest age groups were 20–25 years (63 respondents), 31–35 years (61 respondents), and 36–40 years (54 respondents). Smaller proportions were observed in the 18–20 years (14 respondents) and over 71 years (3 respondents) categories. As shown in Table 1, the most commonly used mode of transportation was public transportation (such as bus, MRT, train, and high-speed rail), followed by private cars/e-cars and private scooters/e-scooters. The reasons for respondents' outings included commuting to work or school (344 out of 406), shopping or errands (178), visiting friends or family (138), leisure or entertainment (165), business travel (100), general travel (108), and medical visits (52).

Table 1: Frequency distribution of primary and secondary transportation modes among respondents.

Transportation Mode	Most Frequently Used (n)	Second Most Frequently Used (n)
Public Transportation (Bus, MRT, Train, High-Speed Rail)	166	93
Private Car/E-Car	111	52

Continued

Table 1: Continued

Transportation Mode	Most Frequently Used (n)	Second Most Frequently Used (n)
Private Scooter/E-Scooter	111	116
Bicycle/E-Bicycle	2	45
Walking	15	92
Shared Vehicles (Scooter, Car, or Bicycle)	1	8

Based on the ANOVA results, significant differences were observed across the dimensions of practicality ($F = 4.43$, $p = 0.01$), convenience ($F = 6.57$, $p < 0.001$), cost ($F = 100.36$, $p < 0.001$), environmental impact ($F = 75.86$, $p < 0.001$), and safety ($F = 38.27$, $p < 0.001$).

Further post-hoc analysis using LSD revealed significant differences in the practicality dimension between public transportation and private scooters ($p < 0.001$). In the convenience dimension, significant differences were found between public transportation and private scooters ($p < 0.001$) and between private cars and private scooters ($p = 0.04$). For the cost dimension, significant differences were identified between public transportation and private scooters ($p < 0.001$), public transportation and private cars ($p < 0.001$), and between private cars and private scooters ($p < 0.001$). In the environmental impact dimension, significant differences were noted between public transportation and private scooters ($p < 0.001$), public transportation and private cars ($p < 0.001$), and between private cars and private scooters ($p < 0.001$). Similarly, in the safety dimension, significant differences were observed between public transportation and private scooters ($p < 0.001$), public transportation and private cars ($p < 0.001$), and between private cars and private scooters ($p = 0.01$). Detailed results are presented in Table 2.

Table 2: Results of ANOVA and LSD post hoc tests for transportation mode satisfaction.

Dimension	Descriptive Statistics			ANOVA		LSD	
	Factors	Mean	S.D.	F	P-Value		P-Value
Practicality	Public Transp. (1)	6.09	0.96	4.43	0.01	1 vs 3	0.00
	Priv. Cars (2)	6.16	0.92				
	Priv. Scooters (3)	6.28	0.83				
Convenience	Public Transp.	6.08	1.04	6.57	0.00	1 vs 3	0.00
	Priv. Cars	6.18	0.94			2 vs 3	0.04
	Priv. Scooters	6.32	0.83				
Cost	Public Transp.	6.07	0.98	100.36	0.00	1 vs 2	0.00
	Priv. Cars	5.00	1.31			1 vs 3	0.00
	Priv. Scooters	5.79	1.02			2 vs 3	0.00
Environmental impact	Public Transp.	6.01	1.08	75.86	0.00	1 vs 2	0.00
	Priv. Cars	4.99	1.26			1 vs 3	0.00
	Priv. Scooters	5.39	1.21			2 vs 3	0.00
Safety	Public Transp.	6.06	1.01	38.27	0.00	1 vs 2	0.00
	Priv. Cars	5.57	1.06			1 vs 3	0.00
	Priv. Scooters	5.35	1.41			2 vs 3	0.01

Continued

Table 2: Continued

Dimension	Descriptive Statistics			ANOVA		LSD
	Factors	**Mean**	**S.D.**	**F**	**P-Value**	**P-Value**
Time efficiency	Public Transp.	5.84	1.17	2.43	0.09	
	Priv. Cars	5.96	1.02			
	Priv. Scooters	6.00	0.91			

DISCUSSION

The sample data from this study indicates that the most commonly used transportation mode was public transportation (bus, MRT, train, and high-speed rail), followed by private cars/e-cars and private scooters/e-scooters. This finding suggests that public transportation remains the primary choice for daily commuting in urban areas, consistent with the well-developed public transport infrastructure in Taipei, northern Taiwan. Additionally, the study identified that individuals aged 20–40 years constituted the largest age group, reflecting the population most likely to engage in frequent commuting.

The ANOVA analysis results reveal significant differences across the five key dimensions, but no significant differences were found in dimensions of time efficiency.

Practicality: Public transportation was rated significantly lower than private scooters in terms of practicality ($p < 0.001$). This suggests that while public transportation is a commonly used mode, private scooters may be perceived as more practical. This could be attributed to the well-established public transport infrastructure in northern Taiwan, which provides consistent and reliable services, especially in urban areas. Both private cars and scooters received similar ratings, indicating comparable levels of practicality for personal use.

Convenience: The results suggest that while all three transportation modes received generally high satisfaction scores (above 6 on a 7-point scale), public transportation was found to be less convenient than both private scooters ($p < 0.001$) and private cars ($p = 0.04$). The convenience of private scooters and cars is likely due to their on-demand availability and independence from public transportation schedules. This difference may arise from the flexibility and ease of maneuverability that scooters provide, especially for short trips and navigating through traffic. Although private cars are somewhat less convenient than scooters, they offer greater comfort and practicality for longer journeys or carrying multiple passengers. Despite being widely available and efficient, public transportation may be perceived as slightly less convenient due to fixed schedules and routes.

Cost: Significant differences were observed across all transportation modes regarding cost, with public transportation being the most affordable ($p < 0.001$). Public transportation was perceived as the most cost-effective option, with an average satisfaction score of 6.07. Private scooters followed with a score of 5.79, reflecting their affordability relative to cars but still higher costs compared to public transportation, likely due to fuel and maintenance expenses. Private cars, with an average score of 5, were the

least cost-effective, possibly due to higher maintenance, fuel, and parking costs associated with car ownership.

Environmental Impact: Public transportation consistently received the highest rating in terms of environmental impact, with private scooters and private cars rated lower. The significant differences ($p < 0.001$) suggest that public transportation, with an average satisfaction score of 6.01, is viewed as the most environmentally friendly and sustainable transportation option, owing to its lower carbon footprint and greater efficiency in reducing emissions compared to private cars and scooters. The significant gap between public transportation and the other modes highlights its role in promoting sustainable urban mobility. Conversely, private cars and scooters received lower ratings (4.99 and 5.39, respectively), reflecting growing concerns about their environmental impact. Private cars are associated with higher emissions and energy use, while scooters, despite being more efficient than cars, still contribute to environmental degradation due to their reliance on fossil fuels and limited energy efficiency. Future research and policy planning should focus on promoting public transportation, incentivizing cleaner alternatives, launching educational campaigns, and integrating transportation modes. These efforts aim to encourage travelers to adopt more sustainable and environmentally friendly transportation options.

Safety: Public transportation was rated significantly safer than both private cars and scooters ($p < 0.001$). Safety was a critical dimension in this study, with public transportation receiving the highest safety rating (average satisfaction score: 6.06), followed by private cars (5.57) and private scooters (5.35). This indicates significant differences in perceived safety across these modes of transportation. The higher safety rating for public transportation aligns with the general perception that regulated systems, such as buses and trains, provide greater safety compared to scooters, which are more prone to accidents, particularly in densely populated urban areas. These findings suggest that public transportation offers a safer travel experience, likely due to the absence of personal responsibility for vehicle operation and the presence of regulated safety measures. The lower safety ratings for private scooters, especially in comparison with cars and public transport, may reflect concerns about accidents, particularly due to the lack of protective infrastructure for scooters in urban areas.

TRANSPORTATION POLICY RECOMMENDATIONS

The findings of this study provide valuable insights for shaping future transportation policies and strategies. The results underscore the need for balanced policies that address both the practical concerns of commuters and the broader goals related to environmental sustainability and safety.

Regarding public transportation, it is recommended to enhance both convenience and incentives for sustainable transport. Although public transportation remains the most affordable and environmentally friendly mode, it received lower ratings in terms of convenience and practicality compared to private scooters and cars. To improve its attractiveness, public transportation could focus on enhancing the user experience, including

reducing wait times, improving comfort, expanding routes, and increasing service frequency. These improvements would be particularly appealing to users who prioritize cost-effectiveness and environmental sustainability over convenience, especially among middle-income individuals. Additionally, policies to further incentivize the use of public transportation could include offering subsidies or tax breaks for frequent riders. Investment in greener technologies for buses and trains could also further enhance the sustainability of public transport, potentially encouraging environmentally-conscious individuals to transition away from private vehicles.

Concerning private scooters and cars, it is important to address safety concerns, reduce costs, and promote environmental impact mitigation. First, the study highlights that while private scooters and cars rank highly in terms of practicality and convenience, safety concerns remain a significant issue. To address this, the development of dedicated infrastructure—such as separate scooter lanes—and the implementation of enhanced road safety regulations should be prioritized to reduce accidents and improve public confidence in these modes of transport. Furthermore, public awareness campaigns promoting safe riding practices could help improve rider behavior and safety. Second, the relatively high costs associated with private scooters and cars, especially in comparison to public transportation, could discourage some potential users. Policies aimed at reducing the operational costs for scooter owners, such as subsidies for electric scooters, tax incentives for eco-friendly vehicle purchases, and reduced registration fees, could help mitigate these financial barriers. Finally, in terms of environmental impact, promoting sustainable choices remains crucial. Given that public transportation is the least environmentally damaging mode and private scooters are growing in popularity, both transportation options should be further encouraged through targeted policy measures. Public transportation could be incentivized through green subsidies or tax rebates. Additionally, promoting the adoption of electric scooters or other eco-friendly technologies in the private scooter market could help reduce emissions and urban pollution. Policymakers should prioritize the development of charging infrastructure and incentives for the purchase of electric scooters to accelerate this transition.

CONCLUSION

This study offers a comprehensive analysis of the factors influencing transportation choices in northern Taiwan, using subjective rating scales to assess the practicality, convenience, cost, environmental impact, and safety of various modes of transportation. The findings reveal significant differences across the three most commonly used transportation modes: public transportation, private cars, and private scooters. Public transportation was found to be the most balanced option, excelling in terms of practicality, safety, and environmental sustainability. In contrast, while private scooters were rated highly for convenience, they were less favorable in terms of cost-effectiveness and environmental impact. Private cars, though offering comfort and practicality for longer trips, were less favored due to their higher costs and environmental concerns.

These results contribute to the growing body of research on urban transportation choices, providing insights that can inform policy decisions aimed at promoting more sustainable transportation options. Policymakers should consider investing in expanding and enhancing public transportation infrastructure, promoting cleaner vehicle technologies, and encouraging a shift towards more environmentally friendly modes of travel.

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