

# Analysing User Experience of E-Scooter Usage: A Human-Computer Interaction Perspective on Personal vs. Shared E-Scooters

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## ABSTRACT

This study aims to investigate the user experience of e-scooter usage by comparing subjective evaluations from riders regarding aesthetic quality, hedonic quality, pragmatic quality, and overall satisfaction between two transportation modes: personal e-scooters and shared e-scooters. A total of 506 valid questionnaires were collected from users of personal e-scooters, and 275 valid questionnaires from users of shared e-scooters. The results indicate that there were no significant differences in user experience between the two transportation modes. Additionally, the results of qualitative data analysis suggested that incentives such as the convenience of charging, subsidies, product promotion, and government support may contribute to the purchase of private e-scooters. However, a small number of respondents expressed negative perceptions about e-scooter products, citing concerns about price, speed, performance, and range anxiety. The research concludes by proposing relevant suggestions to promote the widespread adoption of e-scooter products in the market, based on the findings.

**Keywords:** Sustainability transportation, E-scooter usage, User experience, Shared e-scooters

## INTRODUCTION

In its 2007 assessment report, the Intergovernmental Panel on Climate Change (IPCC) emphasized that human activities, particularly the combustion of fossil fuels, are the primary drivers behind the escalating levels of atmospheric greenhouse gases (Royer et al., 2007; Nakicenovic et al., 2000). Among these activities, the transportation sector stands out as responsible for nearly half of the world's fossil fuel consumption and approximately one-quarter of total CO<sub>2</sub> emissions linked to fossil fuels (IEA, 2010). The resulting environmental and health consequences from road transportation have prompted the formulation of various international policy frameworks. Notably, the global shift towards cleaner air and low-carbon economies aligns with the UN Sustainable Development Goals (SDGs), which offer a unified blueprint for harmonizing people, the planet, and profit (UN, 2017).

In response to these environmental challenges, electric vehicles (EVs) have emerged as a promising solution due to their significantly cleaner emissions profile compared to traditional internal combustion engine vehicles (MIT Energy Initiative, 2019). Consequently, there has been a notable transition from conventional internal combustion engines to EVs as a key component of low-emission mobility strategies (Husain, 2010). In the two-wheeler sector, this transition to environmentally friendly solutions has also extended to electric scooters. These electric scooters have gained significant popularity, especially through e-scooter sharing services, which have rapidly transformed urban transportation. These services provide short to medium-distance travelers with an alternative mode of transportation that is convenient, cost-effective, and promotes environmental sustainability.

With the introduction of shared economy models, the approach to two-wheeler transportation has shifted from traditional ownership to a pay-per-use model. Instead of solely owning an e-scooter, users now have the option to choose between purchasing or renting one through shared e-scooter services. However, the overall user experience of e-scooter usage can still vary based on various factors, including whether they own the scooter or are using a shared service. As electric two-wheeler products are still in the process of market penetration, this research aims to focus on user-centric concepts and conduct a subjective assessment through a questionnaire study, evaluating user experience through four main dimensions: aesthetic quality, hedonic quality, pragmatic quality, and overall satisfaction. By exploring these dimensions, the study aims to understand the differences in subjective user experiences when riding a privately-owned e-scooter compared to using a shared e-scooter. The goal is to identify the strengths and weaknesses of e-scooter products and provide recommendations for enhancing the user experience.

## **ELECTRIC SCOOTER SERVICE AND USER EXPERIENCE**

The sharing economy (SE) is a revolutionary concept that revolves around the efficient utilization of underutilized assets to promote sustainability and optimize resources. It encompasses various activities such as bartering, lending, renting, trading, swapping, and transportation (Heo, 2016). SE can be broadly classified into three main components: the access economy, platform economy, and community-based economy (Acquier et al., 2017). Each of these components plays a crucial role in facilitating the seamless sharing of resources, fostering a sense of community, and promoting collaboration.

Among the components of the sharing economy, the shared motorcycle service primarily falls under the Access Economy category. The access economy focuses on providing individuals with access to products and services without requiring ownership. This model enables temporary use or access to goods, allowing people to enjoy the benefits without committing to the long-term costs associated with ownership. For instance, popular ridesharing services like Uber and home-sharing platforms like Airbnb exemplify the access economy by offering convenient transportation and accommodation options without necessitating personal ownership of a vehicle or property.

The sharing economy offers numerous advantages, making it an appealing and transformative concept. Some of its key benefits include resource optimization, sustainable resource utilization, cost-effectiveness, flexibility, convenience, and social engagement. The sharing economy represents a fundamental shift in how resources are accessed, used, and valued in society. By leveraging underutilized assets and encouraging collaborative consumption, it contributes to a more sustainable and efficient society.

In recent years, there has been a growing interest in user experience (UX) research within the context of shared mobility services. UX evolves from an unconscious state to a cognitive one and eventually becomes “an experience” – something memorable that can be shared and discussed in social interactions (Forlizzi and colleagues, 2004). Users’ experiences develop over time, and as they become more familiar with a product, it is expected that they will encounter fewer frustrating but also fewer exciting moments. Consequently, the perceived quality of a product is likely to change. Perceived quality can be categorized into pragmatic and hedonic aspects (Hassenzahl, 2004). Pragmatic quality refers to the product’s ability to support the achievement of behavioral goals, such as usefulness and ease-of-use. On the other hand, hedonic quality is related to stimulation, reflecting the product’s ability to foster personal growth and identification, indicating its capacity to address the need for self-expression through owned objects. Research has shown that pragmatic quality is a better predictor of user satisfaction, whereas perceptions of a product’s aesthetics are better predictors of pleasant experiences (Tractinsky and Zmiri, 2006).

Even if a product’s design meets specifications and is technologically advanced, studies indicate that if it fails to fulfill users’ true needs (28%) or is solely driven by users’ remorse (20%) (Den Ouden et al., 2006), there is a possibility of product returns. This underscores the importance of consumer-oriented product design in the consumer market, where both technical specifications and users’ actual product usage needs must be met. Therefore, this study focuses on exploring user experiences, emphasizing products’ aesthetics, pragmatic quality, hedonic quality, and overall user satisfaction after product use.

## METHODS

To assess the user experience (UX) of e-scooter usage, a mixed-method approach comprising quantitative surveys and qualitative interviews was employed. For this study, e-scooter riders were selected using convenience sampling, targeting individuals who either owned a personal e-scooter or had utilized shared e-scooters. Participants were asked to rate their experiences on a 10-point Likert scale, providing subjective evaluations for four dimensions: aesthetic quality, hedonic quality, pragmatic quality, and overall satisfaction. Moreover, in-depth interviews were conducted with owners of personal e-scooters to gain deeper insights into the underlying factors influencing their decision to purchase an e-scooter, as well as the perceived disadvantages of owning private e-scooters.

## RESULTS

In this study, a total of 506 valid questionnaires (293 male; 213 female) were collected from users of personal e-scooters, and 275 valid questionnaires (131 male; 144 female) were collected from users of shared e-scooters. The results of the reliability analysis indicate high reliability for both the UX of private e-scooters ( $\alpha = 0.830$ ) and the UX of shared e-scooters ( $\alpha = 0.814$ ), with Cronbach's alpha coefficients exceeding 0.8. The average values and standard deviations of the UX for both private e-scooters and shared e-scooters are presented in Table 1. All values fall within the "very satisfied" range, indicating that both riding private e-scooters and shared e-scooters lead to highly satisfactory user experiences. Furthermore, the results of the one-way ANOVA indicate that there is no significant difference in the UX between private e-scooters and shared e-scooters for aesthetic quality ( $F = 0.098$ ,  $p = 0.754$ ), hedonic quality ( $F = 0.179$ ,  $p = 0.672$ ), pragmatic quality ( $F = 0.275$ ,  $p = 0.600$ ), and overall satisfaction ( $F = 0.401$ ,  $p = 0.527$ ).

**Table 1.** Means and standard deviations (SDs) of private e-scooters and shared e-scooters.

	Items	Mean	SD
Private e-scooters	Aesthetic	7.72	1.78
	Hedonic Quality	7.93	1.63
	Pragmatic Quality	7.82	1.73
	Overall Satisfaction	7.94	1.57
Shared e-scooters	Aesthetic	7.57	1.86
	Hedonic Quality	8.12	1.59
	Pragmatic Quality	7.70	1.72
	Overall Satisfaction	8.01	1.55

Among the 506 respondents, a significant 51.6% of them indicated that the availability of convenient charging services was the primary factor influencing their decision to purchase e-scooters. Following closely behind were various subsidy programs (41.3%) that helped reduce the overall cost of acquiring the vehicle, along with effective marketing strategies (33.4%). They believed that brand-driven promotional activities increased their awareness of e-scooter products, and government initiatives promoting net-zero carbon policies and their connection to e-scooters made them realize how their transportation choices impact global environmental quality, all contributing to their decision to choose e-scooters (see Table 2 for detailed information).

**Table 2.** Reasons for choosing e-scooters.

Items	Frequency	Percentage
Convenience of Charging	261	51.6%
Subsidies	209	41.3%
Product Promotion	107	21.1%
Government Promotion	62	12.3%

The 506 respondents also shared their perceived disadvantages of purchasing e-scooters. Among them, 17.4% considered the high purchase price of e-scooters as the primary drawback. Additionally, 11.1% pointed out the relatively lower top speed of the vehicles, 6.5% expressed concerns about the vehicle's load-carrying capacity and climbing performance, while 5.9% mentioned the range anxiety associated with electric vehicles (see Table 3 for detailed information).

**Table 3.** Disadvantages of private e-scooters.

Items	Frequency	Percentage
Price	88	17.4%
speed	56	11.1%
Performance	33	6.5%
Range Anxiety	30	5.9%

## DISCUSSION

This study employed a subjective measurement approach to assess the user experience (UX) of individuals using private e-scooters and shared e-scooters in Taiwan. There are notable distinctions in the usage of these two types of e-scooters, particularly regarding charging requirements, vehicle availability, and parking arrangements. Private e-scooter riders have the flexibility to charge their vehicles at home, workspaces, charging stations, or battery swapping stations based on their individual needs. On the other hand, for shared e-scooters, the responsibility for charging lies with the operating teams. Therefore, the primary concern for shared e-scooter users is whether they can find available e-scooters nearby when needed and locate legal parking spots for returning the scooters. In contrast, private e-scooters are typically parked in fixed locations known to their owners, eliminating the need to search for available vehicles when required. Surprisingly, the research findings indicate that there were no significant differences in the user experience between the two modes of transportation. Both private e-scooter and shared e-scooter riders reported a highly satisfactory experience.

Regarding private e-scooters, respondents shared their reasons for being willing to purchase e-scooters:

- **Convenience of Charging:** As of the end of June 2023, Gogoro operates 2,041 battery swapping stations known as Gostations, while Kymco Ionex 3.0 has a total of 1,068 stations. Together, there are 3,109 battery swapping stations across Taiwan. Private e-scooter users benefit from the option to conveniently charge their vehicles at home or use battery swapping stations, making it a practical and hassle-free transportation choice compared to shared e-scooter users, who can only access the battery swapping service.
- **Subsidies:** Governments and local authorities offer subsidies or financial incentives to encourage the adoption of electric vehicles, including

e-scooters. These subsidies make e-scooters more affordable and attractive to potential buyers.

- **Product Promotion:** The marketing and promotion of e-scooters can positively influence consumers' transportation choices. As manufacturers and distributors promote the benefits and features of e-scooters, consumers become more aware of their advantages and are more likely to consider them a viable alternative for personal transportation.
- **Government Promotion:** With the global focus on achieving net-zero carbon emissions, governments actively promote sustainable and eco-friendly transportation solutions, such as e-scooters. They often implement policies that support the use of electric vehicles to reduce pollution and ease traffic congestion, further driving the demand for e-scooters among travelers.

Respondents who owned private e-scooters also pointed out some drawbacks of owning personal e-scooters:

- **Price:** The initial investment for private e-scooters, which involves a one-time payment for the vehicle, can be relatively expensive compared to the one-time usage fee for shared electric scooters. This cost difference becomes even more apparent, especially when consumers opt for models with advanced features or higher build quality.
- **Speed:** Private e-scooters have a lower top speed compared to other personal mobility options like scooters and cars. This might not be ideal for individuals who need faster transportation for longer distances.
- **Performance:** E-scooters may have limitations in handling certain terrains, such as steep hills or rough roads. As a result, users with specific route requirements may find that e-scooters cannot fully meet their transportation needs.
- **Range Anxiety:** E-scooters have a limited range per charge, leading to range anxiety – the fear of running out of battery power during a journey. This limitation impacts both the acceptance of shared e-scooters and the decision to own a private e-scooter.

## CONCLUSION

This study aims to investigate the user experience of e-scooter usage. The research findings indicate that respondents are highly satisfied with the current e-scooter products and shared services offered in the market. Additionally, there are no significant differences in user experience between the two transportation modes. However, it is important to note that e-scooter vehicles currently constitute only 2% of the market share in Taiwan, as opposed to traditional motorcycles. To encourage broader adoption, effective market promotion should be based on understanding the reasons why consumers choose e-scooters. Factors such as convenient charging services, subsidy programs, and effective marketing strategies are key considerations. Moreover, addressing concerns related to Price, Speed, Performance, and Range Anxiety, which may trouble consumers, can be tackled by promoting shared e-scooter services, exploring other alternative transportation options, and advancing e-scooter product technology.

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