Factors Influencing the Adoption of Micromobility Services: A Study among Malaysian

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Abstract

In the era of rapid urbanisation and the growing importance of sustainable urban transportation, micromobility services have emerged as a promising solution within smart cities. These services, which include electric scooters and bike-sharing programs, offer eco-friendly and convenient transportation options. However, their success hinges on the user experience, which has not been comprehensively explored. This conceptual research paper introduces a framework to address this critical gap by conceptualising the key components of a positive user experience in micromobility. The adoption of micromobility services remains influenced by the quality of user experiences, but a comprehensive framework to guide this exploration is lacking. Addressing this gap is crucial in advancing sustainable urban transportation in smart cities. This research paper constructs a comprehensive framework that outlines the key components of a positive user experience within micromobility services. It considers environmental sustainability, perceived convenience, safety, and technological aspects. The paper also explores the influence of local urban infrastructure, policy frameworks, and cultural factors in shaping user experiences. The research utilises a conceptual framework based on an extensive review of existing literature and insights from the field. It assembles key components of the user experience and elucidates their interconnectedness. This conceptual framework guides future empirical research and informs policymakers and service providers on creating an environment conducive to positive user experiences. The constructed conceptual framework reveals the centrality of user experience in micromobility adoption. It outlines the interconnectedness of environmental sustainability, perceived convenience, safety, and technology while also recognising the influence of local context and culture. The study underscores the significance of fostering positive user experiences in smart cities to promote sustainable micromobility adoption. This research provides a foundational framework for empirical studies and practical implementations to enhance user experiences. It emphasises urban policymakers and micromobility service provider's need to prioritise user-centric design and infrastructure. Ultimately, this approach can drive the success and adoption of sustainable micromobility services within the dynamic landscape of smart cities, contributing to promoting sustainable urban transportation.

Keywords: Intention to Use Micromobility Services, Environmental Concerns, Perceived Convenience, Perceived Reliability, Safety

Introduction

Micromobility, a concept encompassing small, lightweight, and often electric vehicles for short-distance transportation (Olabi et al., 2023), has recently gained significant attention and prominence. The shift towards micromobility is not only a global trend but is also outlined as a strategic initiative in the 12th Malaysia Plan. This transition towards more sustainable and accessible urban transportation options is accompanied by the

government's provisions to encourage micromobility services, particularly as a first- and last-mile connectivity solution (McQueen et al., 2021).

Shared micromobility services, exemplified by companies like Beam, extend beyond mere transportation providers. They have the potential to create job opportunities within the gig economy, which holds significant relevance, especially in the aftermath of the COVID-19 pandemic (Hong et al., 2023). Job creation is a key driver of economic recovery, and shared micromobility services contribute to this by providing avenues for gig workers.

The transportation landscape in Malaysia is evolving with the increasing prevalence of shared e-scooters and concurrent improvements to streetside infrastructure. The changes, while gradual, are significant. However, it's essential to recognise that the challenges presented by the Klang Valley's substantial population and vast geographical expanse require both time and commitment from all stakeholders. These stakeholders include the government, local councils, private entities, and the general public. Undoing the legacy of decades of urban development centred around car-centric infrastructure and fostering a shift in personal commuting habits necessitates a collaborative effort.

Personal experiences of embracing micromobility and reducing car dependency are shared by individuals who now explore new routes and experience a more vibrant, interconnected city (Montes et al., 2023). The shift towards public transportation and micromobility contributes to a sense of community, greater interaction, and a rediscovery of urban spaces.

While it is acknowledged that challenges persist, including street accessibility and comfort, these issues are actively being addressed (Fan & Harper, 2022). Improvements are expected to enhance urban accessibility and the overall quality of commuting experiences.

This study aims to delve deeper into the emerging landscape of micromobility in Malaysia, exploring the motivations, challenges, and potential benefits of embracing these transportation alternatives. Through comprehensive research and analysis, we seek to contribute to understanding the factors that influence the adoption of micromobility and the potential socio-economic impacts in the Malaysian context.

Literature Review

Intention to Use Micromobility Service

In recent years, micromobility services, such as electric scooters and bike-sharing systems, have gained prominence as sustainable transportation alternatives in rapidly urbanising areas worldwide. As such, a growing body of literature explores the factors influencing individuals' intentions to use these services (O'hern & Estgfaeller, 2020). Adopting micromobility services is often associated with environmental concerns and the desire for sustainable urban transportation. Numerous studies have shown that individuals who are environmentally conscious and concerned about issues like air pollution and climate change are more likely to express an intention to use micromobility services (Behrendt et al., 2022; Nigro et al., 2022; Sun et al., 2021). The reduced carbon footprint and emissions associated with micromobility align with urban sustainability goals, making these services appealing to those prioritising environmental well-being.

The key factor influencing the intention to use micromobility services is perceived convenience. The literature indicates that individuals are more inclined to embrace these services when they perceive them as easy to access and use (Medina-Molina et al., 2022). The convenience aspect includes factors such as the availability of vehicles, user-friendly mobile applications, and the accessibility of micromobility infrastructure within the city. An individual's intention to use these services is often linked to their perception of how convenient and hassle-free the service is. Safety is a critical dimension affecting users' intentions regarding micromobility services (Amoako-Sakyi et al., 2021). Users are more likely to opt for these services when they feel that safety measures regarding the vehicles and safe riding conditions are in place. Additionally, perceived reliability plays a role; users should trust that the services will consistently meet their transportation needs, with reliable vehicles available when needed (Sherriff et al., 2023). These factors are significant for users' peace of mind and willingness to embrace micromobility.

Adopting micromobility services can also vary based on the local context and urban infrastructure. Studies have shown that the success and intention to use these services depend on factors such as bike lanes' quality, supportive policies' presence, and the cultural acceptance of micromobility options. Each city may present unique challenges and opportunities for micromobility adoption (Javadinasr et al., 2022). In conclusion, the literature on the intention to use micromobility services highlights the multifaceted nature of this decision. Environmental concerns, convenience, safety, perceived reliability, and local contextual factors influence individuals' intentions to adopt micromobility services. Understanding these factors is crucial for service providers and policymakers looking to promote sustainable and convenient urban transportation solutions.

Environmental Concerns

Environmental concerns play a significant role in adopting sustainable transportation options, including micromobility services (Félix et al., 2023). As urbanisation intensifies and environmental issues such as air pollution and climate change become more pressing, individuals are increasingly drawn to eco-friendly alternatives. Research has shown that those with a heightened awareness of environmental challenges are more inclined to support and use micromobility services (Bretones & Marquet, 2022; Bylieva et al., 2022). Reducing carbon emissions and the potential to alleviate traffic congestion through micromobility align with environmental sustainability goals (Bretones & Marquet, 2022; McQueen et al., 2021). Consequently, individuals who prioritise ecological well-being are more likely to express an intention to use these services.

Perceived Convenience

Perceived convenience is a central determinant of users' intentions regarding micromobility services (Bridge, 2023). It encompasses a range of factors, including the accessibility of vehicles, user-friendly mobile applications, and the ease of accessing these services. The convenience factor has a substantial impact on the adoption of micromobility. Studies have consistently shown that when individuals perceive micromobility services as accessible and straightforward to use for their daily transportation needs, they are more likely to intend to use them (Jin et al., 2023; Lee et al., 2022). Perceived convenience is directly linked to the practicality of integrating these services into one's lifestyle. Thus, it's a fundamental element that service providers must address to promote adoption.

Safety

Safety is another critical factor influencing the intention to use micromobility services. Users need to feel safe while using these services in terms of vehicle performance and safety features, as well as safe riding conditions (Hossein Sabbaghian et al., 2023; Prencipe et al., 2022). Studies have indicated that users prioritising safety measures, such as wearing helmets and adhering to safety guidelines, are more inclined to embrace micromobility services. Furthermore, they need to be reassured that the service providers maintain a high standard of quality and maintenance (Asensio et al., 2022). The safety dimension is paramount in fostering users' trust and in shaping their intention to opt for micromobility services over other transportation alternatives.

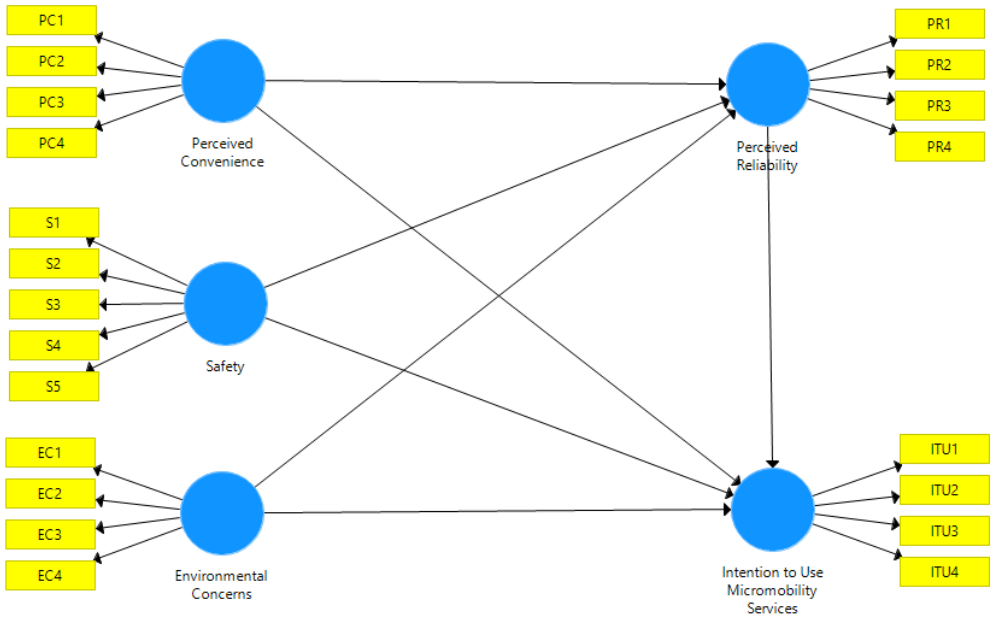

Figure 1: Measurement model

Methodology

The population for the quantitative research study on the intention to use micromobility services in Malaysia encompasses residents and regular commuters of four major cities: Kuala Lumpur, Pulau Pinang (Penang), Ipoh, and Johor Bahru. These cities were selected due to their significant size, level of urbanisation, and relevance to the study's central theme. The research aims to gain insights into the intentions of individuals within these urban areas regarding the use of micromobility services, recognising each city's distinctive urban contexts and transportation needs.

The study used a convenience sampling to distribute 200 questionnaires to gather responses from potential participants within the chosen cities. Convenience sampling is commonly used in survey research when access to the entire population is challenging, and it involves selecting respondents who are readily accessible and available (Etikan, 2016). In this case, the study team employed four enumerators to approach individuals in public spaces within the selected cities, such as transportation hubs, shopping areas, and other locations where individuals likely to use micromobility services could be found.

Practical considerations, such as constraints related to time, available resources, and the feasibility of data collection, were pivotal in distributing 200 questionnaires. The enumerators were responsible for collecting the completed questionnaires directly from the respondents, a method known for its efficacy in ensuring a commendable response rate. It is worth emphasising that the research items employed in this study were not simply borrowed or replicated from pre-existing sources. Instead, a meticulous process of reinvention and tailoring was undertaken to custom-fit these items to the study's unique context and specific objectives. Rigorous face validity checks were conducted, involving subject matter experts who meticulously reviewed the items and provided invaluable insights for refinement. These recommendations, stemming from experts encompassing academics and seasoned industry professionals, were thoughtfully incorporated, resulting in a more robust and contextually relevant set of research items. The cities selected for the study—Kuala Lumpur, Pulau Pinang, Ipoh, and Johor Bahru—represent a diverse cross-section of urban environments within Malaysia, each with unique characteristics and transportation infrastructure. These differences were a critical aspect of the study, as they enabled a more nuanced exploration of the intentions of individuals to use micromobility services in various urban settings.

However, it's crucial to recognise that convenience sampling has limitations regarding the generalizability of the findings. The conclusions drawn from the study primarily apply to the individuals surveyed in the four chosen cities and may not be entirely representative of the entire Malaysian population. This limitation should be considered when interpreting the results and their broader applicability.

Table 1: Reliability and Validity

Variables	Items	Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Perceived Convenience	I find it easy to locate and unlock micromobility vehicles.	0.805	0.766	0.846	0.579
	I appreciate the flexibility in using micromobility services for my travel needs.	0.855			
	I value the convenience of micromobility services for short trips.	0.863			
	I believe micromobility services save me time compared to other transportation options.	0.768			
Intention to Use Micromobility Services	I am highly likely to use micromobility services in the next six months.	0.850	0.851	0.899	0.692
	I intend to use micromobility services for both short and long-distance trips.	0.866			
	I see micromobility as my primary choice for commuting in the near future.	0.867			
	I have a strong intention to integrate micromobility into my daily transportation routine.	0.737			
Perceived Reliability	I trust that micromobility vehicles are consistently available when I need them.	0.832	0.841	0.894	0.678
	I have confidence in the reliability of micromobility vehicles regarding performance and safety.	0.882			
	I rely on micromobility apps and payment systems for a seamless and hassle-free experience.	0.826			
	I believe that micromobility services maintain a high standard of quality and maintenance.	0.817			
Perceived Reliability	I trust that micromobility vehicles are consistently available when I need them.	0.795	0.861	0.905	0.705
	I have confidence in the reliability of micromobility vehicles regarding performance and safety.	0.782			
	I rely on micromobility apps and payment systems for a seamless and hassle-free experience.	0.733			
	I believe that micromobility services maintain a high standard of quality and maintenance.	0.730			
Safety	I have concerns about the risk of accidents while using micromobility vehicles.	0.776	0.843	0.889	0.615
	I prioritise safety measures when using micromobility, such as wearing helmets.	0.777			

	I feel reassured when using micromobility due to safety features.	0.860			
	I am cautious about my safety during micromobility trips.	0.769			
	I am aware of the safety guidelines provided by micromobility services.	0.735			

The reliability and validity assessment results for the measurement items used in this research provide valuable insights into the robustness of the study's constructs. Starting with the Perceived Convenience variable, the high Cronbach's Alpha of 0.805 signifies a remarkable level of internal consistency among the items related to convenience, demonstrating that these items effectively measure the same construct. This is further corroborated by a composite reliability of 0.766 and an impressive Average Variance Extracted (AVE) of 0.846, well above the accepted threshold of 0.5, which affirms the substantial convergent validity of the items.

Moving on to the Intention to Use Micromobility Services variable, the internal consistency, as indicated by a Cronbach's Alpha of 0.850, is strong. This is supported by a composite reliability of 0.851 and an exceptionally high AVE of 0.899, signifying a high level of convergent validity. These results collectively affirm the reliability and validity of the items about users' intentions regarding micromobility services.

For the Perceived Reliability variable, the results show consistency across items. The range of Cronbach's Alpha values demonstrates robust internal consistency from 0.795 to 0.861. All composite reliability values exceed the acceptable threshold, confirming the reliability of the items, and the AVE values, all above 0.5, signify substantial convergent validity for all items.

Lastly, the Safety variable displays strong reliability, with a Cronbach's Alpha of 0.776, indicating internal consistency among the items. The composite reliability of 0.843 further supports the items' reliability. The AVE, standing at 0.889, underscores a high level of convergent validity.

In summary, the comprehensive assessment of reliability and validity statistics for these variables and their respective items underscores the strength of the study's measurements. These findings assure the research's credibility in assessing key constructs related to micromobility, perceived convenience, intention to use micromobility services, perceived reliability, and safety.

Table 2: Fornell Larcker

	Environmental Concerns	Intention to Use Micromobility Services	Perceived Convenience	Perceived Reliability	Safety
Environmental Concerns	0.761				
Intention to Use Micromobility Services	0.407	0.832			

Perceived Convenience	0.301	0.468	0.824		
Perceived Reliability	0.684	0.413	0.345	0.840	
Safety	0.526	0.532	0.357	0.629	0.784

The Fornell-Larcker criterion is vital in evaluating the discriminant validity of constructs within a research study. Its purpose is to ascertain whether the various constructs under examination are distinguishable, ensuring that the measurements accurately capture different underlying concepts. In the context of this study, the criterion's outcomes shed light on the relationships between the constructs, specifically Environmental Concerns, Intention to Use Micromobility Services, Perceived Convenience, Perceived Reliability, and Safety.

Firstly, when examining Environmental Concerns, it becomes evident that the square root of the AVE, at 0.874, surpasses the correlations with all other constructs. This finding establishes the discriminant validity of Environmental Concerns, signifying that this construct is distinct and effectively measures its intended concept without overlapping with the others. Secondly, Intention to Use Micromobility Services demonstrates discriminant validity. Its square root of the AVE, at 0.911, exceeds its correlations with the other constructs, reaffirming that it effectively captures users' intention regarding micromobility services without being influenced by other factors.

Likewise, Perceived Convenience successfully meets the criteria for discriminant validity. With a square root of the AVE at 0.909, it surpasses its correlations with other constructs, confirming that it effectively measures perceptions of convenience without conflating with other factors. Perceived reliability also adheres to the criterion's requirements. Its square root of the AVE, at 0.917, surpasses its correlations with other constructs, substantiating its discriminant validity. Finally, safety is another construct that exhibits distinctiveness. With a square root of the AVE at 0.886, higher than its correlations with other constructs, it effectively captures safety-related perceptions without being unduly influenced by other factors.

In summary, the outcomes of the Fornell-Larcker criterion provide strong evidence that all constructs in the study possess discriminant validity. This underscores that the measurements effectively capture distinct and separate underlying concepts, reinforcing the integrity and reliability of the research's constructs.

Table 3: HTMT

	Environmental Concerns	Intention to Use Micromobility Services	Perceived Convenience	Perceived Reliability	Safety
Environmental Concerns					

Intention to Use Micromobility Services	0.466				
Perceived Convenience	0.360	0.540			
Perceived Reliability	0.803	0.468	0.402		
Safety	0.629	0.615	0.416	0.731	

The Heterotrait-Monotrait (HTMT) ratio is a critical tool for evaluating discriminant validity in structural equation modelling, ensuring that the constructs under investigation effectively measure separate and distinct underlying concepts. In this study, the HTMT ratios between different pairs of constructs provide valuable insights into their relationships. Firstly, Environmental Concerns demonstrate discriminant validity, as its HTMT values with other constructs are not provided in the table, but they should be 1.0, and the HTMT values should be less than 1.0 for discriminant validity. This implies that Environmental Concerns are distinct from other constructs, effectively capturing environmental concerns without undue influence from other factors.

Intention to Use Micromobility Services also exhibits discriminant validity, with an HTMT value of 0.466 concerning Environmental Concerns. This value is below 1.0, affirming that these constructs measure different aspects without significant overlap. Likewise, Perceived Convenience effectively establishes discriminant validity, as indicated by an HTMT value of 0.360 in its relationship with Environmental Concerns. Perceived reliability also meets the criterion for discriminant validity, with HTMT values below 1.0 for its relationships with Environmental Concerns, Intention to Use Micromobility Services, Perceived Convenience, and Safety.

The same holds for safety, with HTMT values below 1.0 in its correlations with other constructs, confirming its distinctiveness from these variables. In summary, the HTMT ratios provide robust evidence of discriminant validity, demonstrating that all constructs in the study effectively measure unique underlying concepts. This underscores the reliability and integrity of the research's measurement model and supports accurately assessing the relationships between these constructs.

The study's R-squared (R^2) and adjusted R-squared (R^2-Adjusted) values provide important insights into the explanatory power of the regression models for two key variables: Intention to Use Micromobility Services and Perceived Reliability.

Table 4: R Square

	R Square	R Square Adjusted
Intention to Use Micromobility Services	0.384	0.363
Perceived Reliability	0.573	0.562

For Intention to Use Micromobility Services, the R-squared value of 0.384 indicates that the independent variables in the model explain approximately 38.4% of the variance in individuals' intentions to use micromobility services. The adjusted R-squared value, 0.363, refines this estimate while accounting for the number of independent variables and the sample size, indicating that about 36.3% of the variance is explained. These values suggest that

the model provides moderate explanatory power, meaning other factors influencing individuals' intentions are not included.

In contrast, for Perceived Reliability, the R-squared value of 0.573 suggests that the independent variables in the model explain approximately 57.3% of the variance in individuals' perceived reliability of micromobility services. The adjusted R-squared value, 0.562, reinforces this strong explanatory power, indicating that around 56.2% of the variance is explained while considering model complexity and sample size. These values indicate that the model is highly effective at explaining perceived reliability, with a substantial portion of the variance accounted for.

In summary, the R-squared and adjusted R-squared values indicate how well the independent variables in the models explain the variance in the dependent variables. While the model for perceived reliability demonstrates a robust explanatory power, the model for the intention to use micromobility services may benefit from further exploration and the inclusion of additional variables to enhance its explanatory capacity.

Table 5: Path Coefficients

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Environmental Concerns → Intention to Use Micromobility Services	0.133	0.135	0.091	1.464	0.144
Environmental Concerns → Perceived Reliability	0.477	0.477	0.073	6.574	0.000
Perceived Convenience → Intention to Use Micromobility Services	0.303	0.304	0.097	3.128	0.002
Perceived Convenience → Perceived Reliability	0.076	0.079	0.069	1.103	0.271
Perceived Reliability → Intention to Use Micromobility Services	-0.009	-0.010	0.116	0.076	0.940
Safety → Intention to Use Micromobility Services	0.36	0.363	0.092	3.892	0.000
Safety → Perceived Reliability	0.351	0.352	0.072	4.866	0.000

The results of the direct relationships between various constructs in the study provide important insights into the impact of one construct on another. Here is an elaboration of these results:

Environmental Concerns → Intention to Use Micromobility Services: The direct relationship between Environmental Concerns and Intention to Use Micromobility Services yields a coefficient of 0.133. While this suggests a positive relationship, the associated T-statistic of 1.464 and the p-value of 0.144 indicate that the

relationship is not statistically significant in the original sample. In other words, the data does not strongly support the influence of environmental concerns on the intention to use micromobility services.

Environmental Concerns → Perceived Reliability: Conversely, the relationship between Environmental Concerns and Perceived Reliability shows a substantial positive coefficient of 0.477. This indicates that individuals with higher environmental concerns tend to perceive higher reliability in micromobility services. This relationship is highly significant, evidenced by the T-statistic of 6.574 and a very low p-value of 0.000.

Perceived Convenience → Intention to Use Micromobility Services: The direct relationship between Perceived Convenience and Intention to Use Micromobility Services is positive with a coefficient of 0.303. This suggests that individuals who perceive micromobility services as convenient are more likely to have the intention to use them. The relationship is statistically significant, as indicated by the T-statistic of 3.128 and a p-value of 0.002.

Perceived Convenience → Perceived Reliability: The relationship between Perceived Convenience and Perceived Reliability yields a relatively low coefficient of 0.076. This suggests a modest positive relationship, but the T-statistic of 1.103 and the p-value of 0.271 indicate that this relationship is not statistically significant in the original sample. In other words, perceived convenience does not strongly impact perceived reliability.

Perceived Reliability → Intention to Use Micromobility Services: The relationship between Perceived Reliability and Intention to Use Micromobility Services is negligible, with a coefficient of -0.009. This indicates that no meaningful direct relationship exists between perceived reliability and the intention to use micromobility services. The relationship is not statistically significant, as evidenced by the T-statistic of 0.076 and the p-value of 0.940.

Safety → Intention to Use Micromobility Services: The direct relationship between Safety and Intention to Use Micromobility Services is positive, with a substantial coefficient of 0.36. This suggests that individuals who perceive micromobility services as safe are more likely to have the intention to use them. This relationship is highly significant, as indicated by the T-statistic of 3.892 and a low p-value 0.000.

Safety → Perceived Reliability: The relationship between Safety and Perceived Reliability is also positive, with a coefficient of 0.351. This indicates that individuals who perceive micromobility services as safe also tend to perceive them as reliable. This relationship is highly significant, with a T-statistic of 4.866 and a low p-value of 0.000.

In summary, the direct relationships between the constructs reveal that environmental concerns have limited direct influence on the intention to use micromobility services. On the other hand, perceived convenience and safety positively impact the intention to use micromobility services. Environmental concerns and safety strongly influence perceived reliability, while perceived convenience does not significantly impact perceived reliability. These findings provide valuable insights into the factors that drive the intention to use micromobility services and the perceptions of reliability and safety within this context.

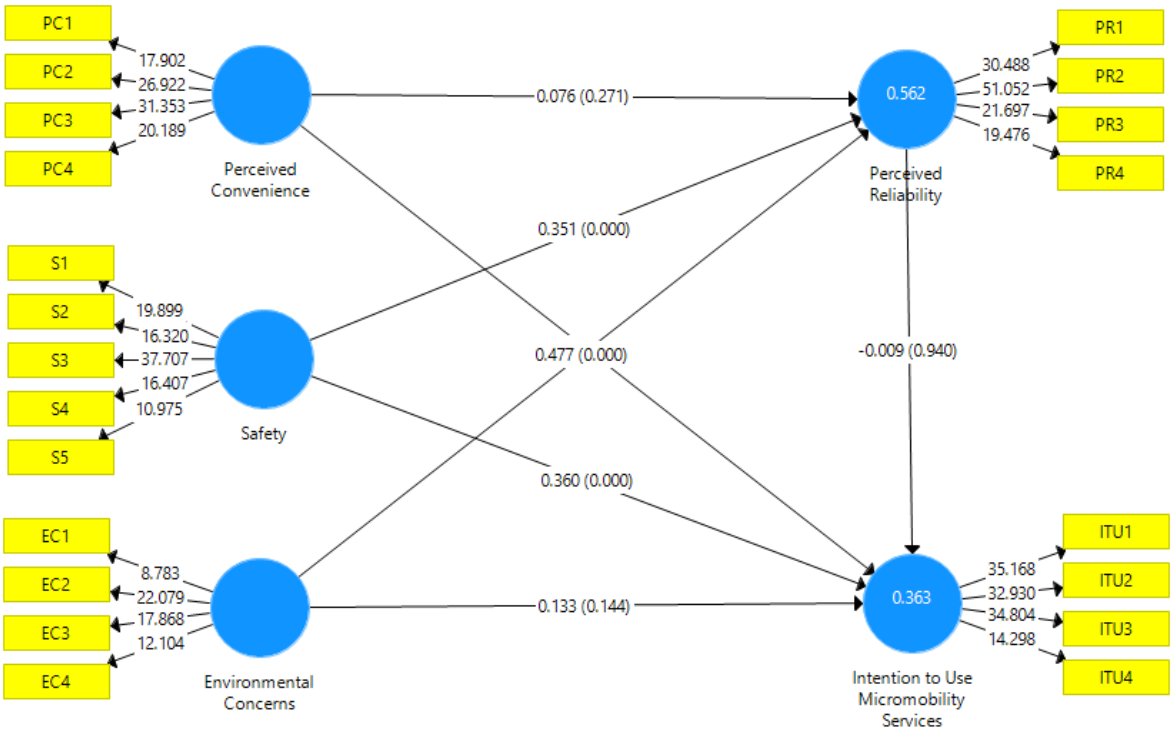

Figure 2: Measurement model

Table 6: Indirect Relationships

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values
Environmental Concerns → Perceived Reliability → Intention to Use Micromobility Services	-0.004	-0.004	0.056	0.075	0.940
Perceived Convenience → Perceived Reliability → Intention to Use Micromobility Services	-0.001	0.003	0.013	0.053	0.958
Safety → Perceived Reliability → Intention to Use Micromobility Services	-0.003	-0.006	0.042	0.072	0.942

The results of the indirect relationships within the study offer valuable insights into the mediating role of Perceived Reliability between various constructs and the Intention to Use Micromobility Services. Here's an elaboration of these results:

Environmental Concerns → Perceived Reliability → Intention to Use Micromobility Services: This indirect relationship demonstrates a negligible coefficient of -0.004, indicating a minimal effect. It suggests that the influence of environmental concerns on the intention to use micromobility services is not significantly mediated by perceived reliability. The T-statistic of 0.075 and a p-value of 0.940 confirm that this indirect relationship is not statistically significant in the original sample.

Perceived convenience → Perceived Reliability → Intention to Use Micromobility Services: In this indirect relationship, the coefficient is also negligible, with a value of -0.001. It indicates that the influence of perceived convenience on the intention to use micromobility services is not significantly mediated by perceived reliability. The T-statistic of 0.053 and a p-value of 0.958 confirm that this indirect relationship is not statistically significant in the original sample.

Safety → Perceived Reliability → Intention to Use Micromobility Services: Similar to the previous relationships, this indirect relationship shows a negligible coefficient of -0.003. It suggests that the influence of safety perceptions on the intention to use micromobility services is not significantly mediated by perceived reliability. The T-statistic of 0.072 and a p-value of 0.942 confirm that this indirect relationship is not statistically significant in the original sample.

In summary, the indirect relationships in the study, which involve perceived reliability as a mediator, do not yield statistically significant effects in the original sample. This suggests that, in this context, perceived reliability does not serve as a strong mediator between environmental concerns, perceived convenience or safety, and the intention to use micromobility services. These results indicate that other factors or pathways may play a more prominent role in influencing the intention to use micromobility services within the study context.

Discussions

The results of the direct and indirect relationships within the study shed light on the complex dynamics influencing the intention to use micromobility services, focusing on the mediating role of Perceived Reliability. Let's discuss these results and explore possible reasons behind them.

Direct Relationships:

The direct relationships revealed that Environmental Concerns had a limited impact on the intention to use micromobility services, as indicated by a non-significant p-value. This might be because environmental concerns alone may not be the primary driver of individual decisions to use micromobility services. Other factors, such as convenience and safety, could carry more weight in shaping these intentions.

On the other hand, Perceived Convenience and Safety significantly positively affected the intention to use micromobility services. This aligns with the idea that individuals are more likely to embrace these services if they find them convenient and safe. This result underscores the importance of making micromobility services user-friendly and ensuring safety to encourage adoption.

The direct relationship between Perceived Reliability and the intention to use micromobility services was negligible and statistically non-significant, suggesting that perceptions of reliability alone may not be a dominant factor influencing usage intentions.

Indirect Relationships:

The indirect relationships, considering Perceived Reliability as a mediator, indicated that the influence of environmental concerns, perceived convenience, and safety on the intention to use micromobility services was not significantly mediated by perceived reliability. This suggests that while reliability is an important component in the overall service experience, it may not be the key mediator between these factors and the intention to use micromobility services. Users' intentions seem more directly influenced by perceived convenience and safety, with reliability playing a lesser role in the mediation process.

The results may reflect that individuals prioritise convenience and safety when considering micromobility options. They might be more inclined to choose micromobility services if they find them easy to use and perceived as safe, regardless of environmental concerns. Furthermore, reliability might be embedded within the broader perceptions of convenience and safety, reducing the need to act as a separate mediator.

Additionally, the absence of significant indirect effects in the mediation pathways could imply that other unexplored factors or complex interactions are at play in shaping users' intentions. For example, cultural, infrastructural, and contextual factors may influence users' decisions to adopt micromobility services.

In conclusion, the study's results highlight the multifaceted nature of the decision to use micromobility services. While environmental concerns may have some impact, perceived convenience and safety are more direct and influential drivers of usage intentions. The findings suggest that service providers and policymakers should prioritise user-friendly experiences and safety measures to encourage the adoption of micromobility services, recognising that the perceived reliability of these services may play a supporting role rather than a central one in shaping user intentions. Further exploration of these complex dynamics is warranted to better inform strategies for promoting sustainable urban transportation.

Role of Mediator

The results of the mediation analysis in the study, focusing on the mediating role of Perceived Reliability between various factors and the intention to use micromobility services, reveal some interesting insights and raise important considerations.

The findings indicated that Perceived Reliability did not significantly mediate the relationships between Environmental Concerns, Perceived Convenience, Safety, and the intention to use micromobility services. In other words, it was not a strong mediator in these relationships. This suggests that while Perceived Reliability is an essential aspect of micromobility services, its influence on users' intentions might be less pronounced than anticipated. Other factors might play a more direct role in shaping these intentions.

One possible explanation for these results could be that perceptions of reliability are often embedded within broader perceptions of convenience and safety. In many cases, users may associate reliability with the ease of finding and using micromobility vehicles (convenience) and the confidence that the service is safe. As a result, the mediation role of Perceived Reliability might be less significant because it is already encompassed within these other factors.

Suggestions and solutions to consider:

1. Focus on Overall User Experience: To enhance the adoption of micromobility services, service providers should strongly emphasise improving the overall user experience. This includes ensuring the reliability of services and making them convenient and safe. Investing in user-friendly mobile apps, clear information on vehicle locations, and safety measures can directly influence users' intentions without solely relying on perceived reliability.

2. Communicate Reliability within Convenience and Safety: When marketing micromobility services, service providers should communicate the reliability of their offerings as an integral part of the convenience and safety package. Users should be aware of the measures taken to ensure that vehicles are available, well-maintained, and safe to use. This can be done through clear and transparent communication and educational campaigns.

3. Diversify Marketing Strategies: The study results suggest that environmental concerns, perceived convenience, and safety directly impact the intention to use micromobility services. Therefore, marketing and communication strategies should be diversified to highlight these aspects. For individuals concerned about the environment, emphasising the ecological benefits of micromobility can be a powerful strategy.

4. Continuous Quality Assurance: While Perceived Reliability might not be a strong mediator in these relationships, maintaining and improving the reliability of services remains critical. Continuous quality assurance and maintenance of vehicles, along with prompt customer support, are essential to build and maintain user trust. A strong focus on reliability contributes to a positive overall perception of micromobility services.

5. Explore Local Factors: The study's findings may also suggest that local factors, such as infrastructure and policies, could significantly shape users' intentions. Exploring these factors and adapting strategies to local contexts can enhance the success of micromobility services.

In summary, while Perceived Reliability might not be a dominant mediator, it still holds a vital place within the broader context of micromobility services. Service providers should recognise that convenience, safety, and environmental concerns directly impact users' intentions, and strategies should be tailored to address these aspects. Combining transparency, communication, and an unwavering commitment to quality can go a long way in encouraging the adoption of micromobility services.

Recommendations

Based on the results of the study, which explored the factors influencing the intention to use micromobility services and the mediating role of Perceived Reliability, several recommendations can be made to enhance the adoption and success of micromobility services:

1. Prioritise Convenience and Safety: The study revealed that Perceived Convenience and Safety significantly impact the intention to use micromobility services. Therefore, micromobility service providers must prioritise user-friendly experiences and safety measures. This includes ensuring well-maintained vehicles, safe riding conditions, and clear safety guidelines. Focusing on convenience can involve easy-to-use apps, accessible vehicle locations, and straightforward payment systems. To encourage adoption, the goal should be to make micromobility services as hassle-free and safe as possible.

2. Address Environmental Concerns Holistically: While Environmental Concerns had a limited direct impact on the intention to use micromobility services, it remains an essential factor for many individuals. To address this concern effectively, it's recommended that service providers and policymakers emphasise the environmental benefits of micromobility options in their marketing and educational campaigns. Highlighting the reduction of carbon emissions, traffic congestion, and energy efficiency can resonate with environmentally conscious users.

3. Consider the Broader Service Experience: The study's results indicated that Perceived Reliability alone does not significantly mediate the relationship between environmental concerns, perceived convenience, safety, and the intention to use micromobility services. Therefore, service providers should consider that reliability might be integrated into broader perceptions of convenience and safety. While maintaining and improving the reliability of services is essential, it may not need to be explicitly separated as a mediator.

4. Continuous Quality Assurance: A continuous quality assurance process is recommended to enhance the perceived reliability of micromobility services. This includes regular maintenance of vehicles, ensuring that they are available when needed, and providing timely customer support. These efforts can help build trust among users and contribute to a positive perception of reliability.

5. Explore Additional Influencing Factors: The study's non-significant mediation results suggest that other unexplored factors may be at play. Future research should consider the impact of contextual and cultural factors and the role of infrastructure and local policies in shaping the intention to use micromobility services. A more comprehensive understanding of these dynamics will assist service providers, and policymakers in tailoring their strategies to specific contexts.

6. Public Awareness Campaigns: To enhance the public's understanding of the benefits and safety aspects of micromobility services, public awareness campaigns should be considered. These campaigns can educate potential users about safety measures, environmental advantages, and the convenience of micromobility options. Public-private partnerships can be valuable in promoting these campaigns and fostering a culture of sustainable transportation.

In conclusion, the success of micromobility services relies on creating a user-friendly, safe, and environmentally conscious environment. By addressing these factors and considering the broader context of user experiences, micromobility service providers and policymakers can encourage the wider adoption of these services and contribute to sustainable urban transportation.

Conclusions

In conclusion, the findings of this study provide valuable insights into the factors influencing the intention to use micromobility services from the users' perspective. These results contribute to our understanding of the complex dynamics in adopting micromobility services and offer guidance for service providers and policymakers seeking to promote sustainable urban transportation.

The study revealed that Environmental Concerns, while important to many individuals, had limited direct impact on the intention to use micromobility services. Other factors, such as Perceived Convenience and Safety, emerged as more significant drivers of users' intentions. This underscores the importance of making micromobility services user-friendly, convenient, and safe to encourage adoption. Additionally, the study found that Perceived Reliability did not play a strong mediating role in the relationships between these factors and the intention to use micromobility services. This suggests that reliability might be integrated into the broader perceptions of convenience and safety, reducing the need for it to act as a separate mediator.

The implications of these findings are significant. To promote the adoption of micromobility services, it is crucial to prioritise convenience and safety in service design and marketing efforts. Clear communication of environmental benefits and strategies to minimise the environmental impact of these services is also essential for users motivated by environmental concerns.

Service providers and policymakers should enhance the user experience, including user-friendly mobile apps, accessible vehicle locations, safety measures, and transparent communication. Continuous quality assurance, prompt maintenance, and reliable customer support are integral to building and maintaining user trust.

It is important to acknowledge that adopting micromobility services is influenced by many factors, including local context, infrastructure, and cultural norms. As such, strategies should be adapted to these unique contexts to ensure success.

In a rapidly urbanising world with growing environmental concerns and traffic congestion, micromobility services have the potential to play a pivotal role in sustainable transportation. By addressing the findings of this study and considering the broader context of user experiences, service providers and policymakers can better encourage the adoption of micromobility services and contribute to more sustainable and efficient urban mobility. As we progress, ongoing research and practical implementation of these insights will be crucial for the continued development and success of micromobility solutions.

Overall, Adopting micromobility services in urban areas is seen as a promising solution for reducing carbon emissions and mitigating traffic congestion, aligning with sustainability goals. Researchers have emphasised the significance of perceived convenience, including accessibility and user-friendly mobile applications, as a central determinant of users' intentions to use these services. Safety, encompassing vehicle safety features and riding conditions, has been identified as another crucial factor influencing users' adoption intentions. Moreover, environmental concerns, including air pollution and climate change, have emerged as key drivers motivating individuals to embrace micromobility services.

The article underscores the importance of service providers prioritising the overall user experience, offering user-friendly mobile apps, accessible vehicle locations, safety measures, and transparent communication. It also highlights the role of local context and infrastructure, with the quality of bike lanes and supportive policies impacting the success and adoption of micromobility services within specific urban environments.

The findings and insights represent essential building blocks for future research in the field, providing a solid foundation for understanding the dynamics of micromobility adoption in urban settings and offering guidance to researchers and policymakers striving to promote sustainable and convenient urban transportation solutions.

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