BEHAVIORAL DRIVERS OF BATTERY RICKSHAW PREFERENCE: CONSUMER ACCEPTANCE, SAFETY RISKS, AND REGULATORY FRAMEWORKS

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ABSTRACT

Once banned for safety and regulatory purposes, battery rickshaws in Bangladesh have seen a recent upsurge in popularity as an affordable and convenient means of transportation for short distances in urban areas. Due to mounting concerns for the health effects associated with the physical exertion of rickshaw pulling, a significant proportion of rickshaw-pullers have increasingly shifted towards battery rickshaws. Nevertheless, several major issues continue to exist regarding unauthorized battery charging, tax avoidance, and roadworthy driving on the streets. The aim of this exploratory study is to identify the contextual and behavioral factors that promote the acceptance of battery rickshaws, using Structural Equation Modeling (SEM). The research was conducted using a structured survey of 242 individuals. After conducting a thorough data screening to eliminate incomplete and invalid entries, 218 valid samples were retained. Exploratory Factor Analysis (EFA) was first conducted to uncover underlying dimensions, resulting in six key constructs: Subjective Norm, Attitude Towards Battery Rickshaw, Usage Intention, Practical Experience & Constraints, Road-Sharing Perception, and Support for Sustainable Urban Transport. Confirmatory Factor Analysis (CFA) then validated the reliability and construct validity of the measurement model, which demonstrated a satisfactory fit. Finally, SEM analysis was applied to examine the structural relationships among the constructs and evaluate their direct and indirect effects on user intention and preference. According to the findings, subjective norms and attitudes towards battery rickshaws positively influence usage intention, whereas road-sharing perception further enhances these behavioral choices. In contrast, practical experience and constraints negatively affect intention, implying that operational complexity-related challenges may deter wider acceptance. Additionally, support for sustainable urban transport does not directly influence usage intention; however, it has a significant impact on improving practical experience and reducing constraints and thus indirectly enhances user acceptance. In spite of increased use of battery rickshaws, issues of safety, especially sudden turns and driver impatience, remain unsolved. The paper explains the changing urban transport mode choices in Bangladesh and highlights areas for policy intervention along with the safe integration of the battery rickshaw in the transport system.

Keywords: *Battery rickshaw; Structural Equation Modeling (SEM); Urban transport; Behavioral analysis; Urban mobility*

1. INTRODUCTION

Rickshaws are a defining feature of short-distance urban transport in Bangladesh, providing affordable and flexible last-mile connectivity in dense, mixed-traffic areas. Their dominance, particularly in Dhaka, makes them central to discussions on non-motorized transport, road space allocation, and sustainable mobility (Hoque & Mahmud, 2009; Replogle & Kodransky, 2010). Recently, battery-powered rickshaws have proliferated across cities, offering a faster and less labor-intensive alternative to pedal rickshaws. Yet, their unregulated operation has raised concerns about traffic congestion, energy misuse, and safety.

Urban and peri-urban transport has undergone a notable shift with the widespread adoption of battery rickshaws, which fill service gaps left by traditional modes (Alam & Habib, 2020; ITDP, 2011). Despite challenges such as informal electricity sourcing, weak regulatory oversight, and safety risks, these vehicles provide improved livelihoods for drivers by reducing physical strain (Depuru, Wang, & Devabhaktuni, 2011; Smith, 2004; SREDA, 2015). While prior studies have identified these operational issues, the continued growth of battery rickshaws underscores the need to examine commuter acceptance and the factors influencing both adoption and resistance.

Existing literature offers limited insight into external and behavioral determinants of acceptance. (Uddin et al., 2022) reported higher acceptance in rural areas due to a lack of affordable alternatives, whereas urban adoption remains constrained by congestion and regulatory restrictions. (Rahman, 2025) found high acceptance among drivers because of greater income potential, while (Ahmed & Rahman, 2023) noted safety concerns, particularly among women and older passengers at night. However, few studies have connected commuter perceptions with actual behavioral tendencies toward battery rickshaw use.

This study addresses that gap by applying a behaviorally informed framework grounded in key constructs from the Theory of Planned Behavior (TPB). Integrating psychological factors (attitude, subjective norm, and usage intention) with contextual determinants (environmental awareness, policy attitude, road-sharing perception, and practical experience), the study employs Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) data from 218 respondents to identify the direct and indirect pathways influencing commuter preference for battery rickshaws over pedal rickshaws.

2. DATA COLLECTION

Data involved in the study were collected from a Revealed Preference (RP) survey that aimed at recording respondents' perceptions, experiences, and riding intentions of battery-operated rickshaws in Dhaka. In view of temporal and logistical limitations, the survey questionnaire was conducted primarily through an online platform, supplemented by limited in-person distribution to ensure diversity in responses. A total of 242 responses were initially obtained, of which 218 valid samples were retained after data screening for incomplete and invalid entries.

There were two parts of the questionnaire: part one gathered socio-demographics of respondents like age, gender, income, occupation, and mobility ownership, and part two consisted of attitudinal and perceptual variables, including respondents' perceptions towards battery rickshaw services, safety concerns, awareness of regulations, and overall acceptability of the mode. The socio-demographic factors are presented in **Table 1**.

Responses pertaining to attitudinal and perceptual constructs were assessed utilizing a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). In total, 17 observed variables were included, corresponding to six latent constructs: Attitude Toward Battery Rickshaw, Subjective Norms, Usage Intention, Practical Experience and Constraints, Road-Sharing Perception, and Support for Sustainable Urban Transport.

Table 1. Summary of Demographic Profiles and Travel Behavior Patterns

Demographic Characteristics & Travel Behaviors	Level	Percentage
Gender	Male	68.3%
	Female	31.7%
Age	Younger Adults (≤35 years)	72.02%
	Older Adults (>35 years)	27.98%
Monthly Household Income (BDT)	0 - 39,999	33.5%
	40,000 - 69,999	28%
	70,000 - 99,999	18.3%
	1,00,000+	20.2%
Primary Travel Mode	Walking	11%
	Public Transport	25.7%
	Private Car	7.8%
	Rickshaw	37.2%
	Other Transport	18.35%
Personal Vehicle Ownership	Yes	27.5%
	No	72.5%
Frequency of Battery Rickshaw Use	Daily (use every day)	30.3%
	Weekly (use once or more each week, but not every day)	28.4%
	Occasionally (use sometimes, but not regularly)	39%
	Never	2.3%

The scales of measurement were determined by a systematic procedure that involved the operationalization of constructs, item development, pilot testing, and statistical verification. Constructs were distinguished by referring to established theoretical paradigms, such as the Theory of Planned Behavior by Ajzen (1991) as well as past studies relating to the adoption of technologies and behavioral intention by Davis (1989). Items were drawn from existing literature but adapted to capture the urban transport environment of Dhaka, thus providing contextual relevance as well as methodological strength. The final set of latent constructs, their observed indicators, retained items, and supporting references are presented in **Table 2**.

Table 2. Latent constructs, observed variables, retained items, and references

Latent Variable	Observed Variables (Items)	Items Retained	References
Attitude Toward Battery Rickshaw (AB)	AB1: Battery rickshaws meet my transportation needs when I cannot use or afford a private vehicle. AB2: Battery rickshaws are a convenient option for short trips. AB3: Battery rickshaws contribute to reducing air and noise pollution in Dhaka. AB4: I feel positive about using a battery rickshaw whenever I want to.	4	(Ajzen, 1991; Hair et al., 2019)
Subjective Norm (SN)	SN1: My family and friends support my use of battery rickshaws. SN2: People close to me encourage me to use battery rickshaws. SN3: People I care about expect me to choose battery rickshaws for part of my daily travel.	3	(Ajzen,1991)
Usage Intention (UI)	UI1: I intend to use battery rickshaws more often in the near future.	4	(Ajzen, 1991; Davis, 1989)

	UI2: I will recommend battery rickshaws to friends and family. UI3: I consider battery rickshaws a viable long-term transport option for myself. UI4: I believe battery rickshaws should be allowed on all city roads.		
Practical Experience & Constraints (PEC)	PEC1: I feel unsafe when using battery rickshaws in heavy traffic. PEC2: Charging issues (low battery, mid-trip breakdowns) make me hesitant to use them.	2	(Nunnally & Bernstein, 1994)
Support for Sustainable Urban Transport (SSUT)	SSUT1: I support battery rickshaws as an environmentally friendly urban transport solution. SSUT2: I support training programs for rickshaw drivers to promote safer urban transport.	2	(Fornell & Larcker, 1981; Hair et al., 2019)
Road-Sharing Perception (RS)	RS1: I feel more confident overtaking a battery rickshaw than a paddle rickshaw. RS2: Battery rickshaws should replace paddle rickshaws in busy zones.	2	(Ajzen, 1991; Hair et al., 2019)

3. METHODOLOGY

After data collection, this study aimed to use a quantitative research design using a survey-based approach to explore the relationships among latent constructs. The methodology involved data collection and a two-stage analytical procedure: Factor Analysis and Structural Equation Modelling (SEM). **Figure 1** illustrates the framework and design of the study.

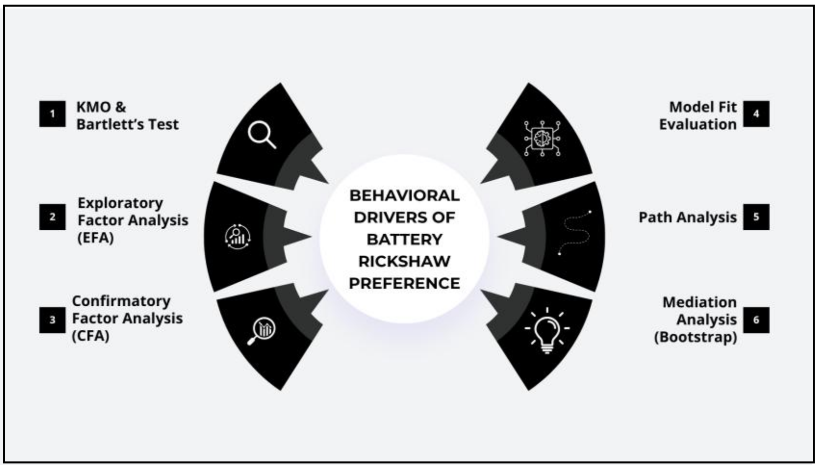

Figure 1. Framework of the study

3.1 Factor Analysis:

The Kaiser–Meyer–Olkin (KMO) test (Kaiser, 1974) and Bartlett's test of sphericity (Bartlett, 1954) assessed data suitability for factor analysis. The KMO value of 0.823, within the excellent range (Hair et al., 2019), confirmed sampling adequacy. Bartlett's test yielded a p-value below 0.05 (Field, 2018), verifying that the data were suitable for factor analysis. Results are shown in **Table 3**.

Table 3. KMO & Bartlett's test results

Test	Parameter	Values
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.823
Bartlett's Test of Sphericity	Approx. Chi-Square	881.411
	df	136
	Sig.	0.000

3.1.1 Exploratory Factor Analysis (EFA)

Following the assessment of data suitability, we performed Exploratory Factor Analysis (EFA) using Principal Component Analysis (PCA) with Varimax rotation to uncover latent factors represented by the Likert-scale items (Hair et al., 2019; Tabachnick & Fidell, 2019). Retaining factors with eigenvalues exceeding 1.0 (Kaiser, 1960), we removed items with loadings below 0.5 or significant cross-loadings, following standard recommendations (Hair et al., 2019). This analysis revealed a clear, six-factor structure that explained 65.76% of the cumulative variance, indicating that the extracted factors reliably represent the underlying constructs (Hair et al., 2019; Field, 2018). Each factor was subsequently interpreted by examining the loadings of its associated items (Field, 2018). **Table 4** summarizes the factor loadings for all items, showing how each item contributes to its respective factor.

Table 4. The component matrix of items in proposed model

Observed Variable	Component					
	1	**2**	**3**	**4**	**5**	**6**
SN1	.625					
SN2	.782					
SN3	.805					
UI1		.572				
UI2		.673				
UI3		.710				
UI4		.709				
AB1			.811			
AB2			.752			
AB3			.567			
AB4			.562			
PEC1				.851		
PEC2				.617		
SSUT1					.806	
SSUT2					.644	
RS1						.828
RS2						.554
Eigenvalue	4.846	1.771	1.244	1.177	1.091	1.051
Contribution of Variance (%)	13.777	13.200	12.497	9.231	8.593	8.461
Accumulated Contribution of Variance (%)	13.777	26.978	39.475	48.706	57.298	65.760

3.1.2 Confirmatory Factor Analysis (CFA)

To ensure that the measurement model accurately represented the constructs of interest, CFA was conducted using SPSS v.26.0 and AMOS v.25.0 (Hair et al., 2019; Kline, 2016). CFA assessed whether the observed variables reliably measured their respective latent constructs and evaluated the overall model fit. This step was essential to confirm the reliability and validity of the instrument before testing the hypothesized relationships. All items had factor loadings above 0.50, indicating significant contributions to their constructs (Hair et al., 2019; Kline, 2016). The overall internal consistency of the scale, measured by Cronbach's alpha, was 0.766—above the 0.70 threshold, confirming satisfactory reliability (Nunnally & Bernstein, 1994).

3.1.2.1 Convergent Validity and Reliability

Convergent validity was examined to determine whether items within each construct captured the same underlying concept (Hair et al., 2019; Fornell & Larcker, 1981). Composite Reliability (CR) values exceeded 0.60 for all constructs, meeting the minimum requirement and approaching the preferred 0.70 cutoff. Although some constructs (SSUT, AB, PEC, RS) had Average Variance Extracted (AVE) values slightly below 0.50, convergent validity remained acceptable since CR values were above 0.60 (Fornell & Larcker, 1981). These lower AVE scores likely reflect construct breadth rather than measurement error. Overall, the model demonstrates adequate convergent validity, as summarized in **Table 5**.

Table 5. Analysis results of convergent validity and reliability

Variable	Factor Loading	Composite Reliability	Variance Extraction
Attitude towards the Behavior			
AB1	0.613	0.748	0.426
AB2	0.650		
AB3	0.696		
AB4	0.650		
Subjective Norm			
SN1	0.632	0.753	0.507
SN2	0.810		
SN3	0.683		
Usage Intention			
UI1	0.723	0.809	0.519
UI2	0.863		
UI3	0.627		
UI4	0.643		
Practical Experience and Constraints			
PEC1	0.728	0.651	0.483
PEC2	0.661		
Road Sharing Perception			
RS1	0.640	0.652	0.492
RS2	0.758		
Support for Sustainable Urban Transport			
SSUT1	0.707	0.625	0.455
SSUT2	0.641		

3.1.2.2 Discriminant Validity

To confirm that the constructs measured distinct concepts, discriminant validity was assessed following Hair et al. (2019) and Fornell and Larcker (1981). Using the Fornell–Larcker criterion, the square root of each construct's AVE exceeded its correlations with other constructs, including the relatively high correlation between Subjective Norm (SN) and Usage Intention (UI), indicating adequate distinctiveness. Given this correlation, the Heterotrait–Monotrait (HTMT) ratio was also examined for robustness. All HTMT values were below the conservative 0.85 threshold (Henseler, Ringle, & Sarstedt, 2015), confirming that the constructs are sufficiently independent and that the measurement model is appropriate for testing structural relationships. The results are summarized in **Tables 6** and **7**.

Table 6. Analysis results of discriminant validity

	SSUT	AB	SN	UI	PEC	RS
SSUT	**0.675**					
AB	0.327	**0.653**				
SN	0.037	0.564	**0.712**			
UI	0.098	0.619	0.697	**0.720**		
PEC	0.392	-0.254	-0.272	-0.554	**0.695**	
RS	0.224	0.532	0.537	0.519	-0.496	**0.701**

3.1.2.3 Model Fit Indices

To assess how well the CFA measurement model fits the observed data, several absolute and incremental fit indices were examined (**Table 8**). These results suggest that the measurement model provides a good fit to the data. Combined with the findings from the CFA, including acceptable reliability, convergent validity, and discriminant validity, the model demonstrates a solid foundation for testing the hypothesized structural relationships in the subsequent SEM analysis (Hair et al., 2019; Kline, 2016).

Table 8. Analysis results of the validation factor analysis

Table 7. Heterotrait - Monotrait (HTMT) Ratios

RELATION			RATIO	RELATION			RATIO
RS	→	SSUT	0.228310147	PEC	→	UI	0.557685551
RS	→	PEC	0.50404401	PEC	→	SN	0.273384688
RS	→	SN	0.546372512	PEC	→	AB	0.336206763
RS	→	AB	0.542761416	UI	→	SN	0.703274593
SSUT	→	PEC	0.392294288	UI	→	AB	0.625160896
SSUT	→	UI	0.098207493	SN	→	AB	0.569036644
SSUT	→	SN	0.037045319				

Fit Index	Goodness-of-Fit Index	Evaluation Criteria	Values	Evaluation Results	References
Absolute fit index	χ 2/df	<3, good fit; <5, reasonable fit	1.428	good fit	(Hair et al., 2019; Kline, 2016)
	GFI	>0.9, good fit	0.916	good fit	(Hair et al., 2019; Hu & Bentler, 1999)
	RMSEA	<0.05, good fit; <0.08, reasonable fit	0.0575	reasonable fit	(Browne & Cudeck, 1993; Hu & Bentler, 1999)
Relative fit index	TLI	>0.9, good fit	0.925	good fit	(Hair et al., 2019; Hu & Bentler, 1999)
	CFI	>0.9, good fit	0.943	good fit	
	IFI	>0.9, good fit	0.945	good fit	

3.2. Structural Equation Modelling (SEM): path analysis and hypothesis test

3.2.1 Hypotheses Testing Results

The SEM of travelers' battery rickshaw usage intention is presented in **Figure 2**. Model fit was assessed computed using AMOS v.25.0 (IBM Corp., 2017) (Hair et al., 2019; Kline, 2016; Hu & Bentler, 1999). As shown in **Table 9**, all values satisfied the recommended thresholds, demonstrating that the proposed theoretical model provides a satisfactory representation of the sample data.

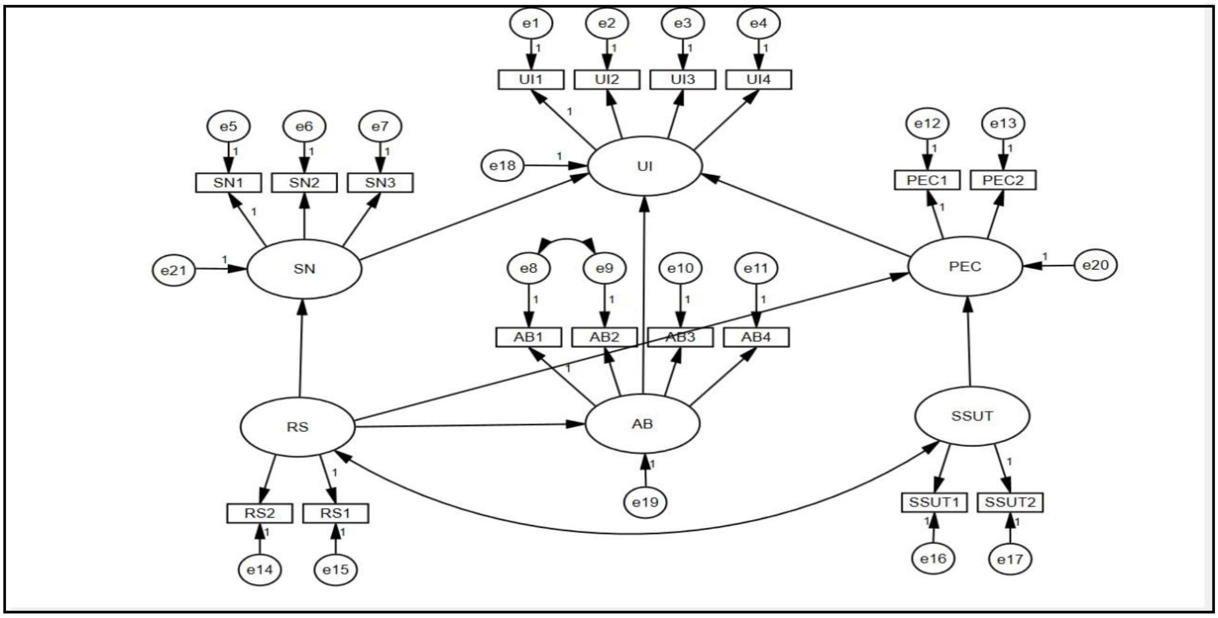

Figure 2. Structural Equation Model of Behavioral Drivers of Battery Rickshaw Preference

Table 9. Fitting indices of the SEM

Fit Index	Goodness-of-Fit Index	Evaluation Criteria	Values	Evaluation Results	References
Absolute fit index	χ2/df	<3, good fit; <5, reasonable fit	1.298	good fit	(Hair et al., 2019; Kline, 2016; Hu & Bentler, 1999)
	GFI	>0.9, good fit	0.919	good fit	
	RMSEA	<0.05, good fit; <0.08, reasonable fit	0.0548	reasonable fit	
Relative fit index	TLI	>0.9, good fit	0.948	good fit	
	CFI	>0.9, good fit	0.958	good fit	
	IFI	>0.9, good fit	0.959	good fit	

3.2.2 Path Analysis

The analysis reveals that the structural relationships among latent constructs and their corresponding observed measures attain statistical significance. All exogenous–endogenous relationships satisfy the requirements of significance. Furthermore, the regression weights are all in the expected directions, consistent with the theoretical model shown in **Figure 2**. The verification of the hypotheses is summarized in **Table 10**.

Table 10. Results of the hypothesis test.

Hypothesis	Path	Estimate	S.E.	CR	P	RESULTS
H1	SN → UI	0.410	0.12	3.975	***	Supported
H2	AB → UI	0.345	0.202	2.926	**	Supported
H3	PEC → UI	-0.290	0.115	-2.722	**	Supported
H4	RS → SN	0.675	.186	4.493	***	Supported
H5	RS → AB	0.754	.1610	3.938	***	Supported
H6	RS → PEC	-0.609	0.2250	-3.637	***	Supported
H7	SSUT → PEC	0.468	0.294	2.707	**	Supported

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

3.2.3 Results of the Mediation Effects Test

Several approaches are commonly applied to examine mediation effects, including the causal steps method, the Sobel test, and the Bootstrap method. Among these, the Bootstrap approach is widely considered the most robust because it does not assume normality of the sampling distribution (Preacher & Hayes, 2004, 2008). Accordingly, this study employed the Bootstrap procedure in AMOS v.25.0 (IBM Corp., 2017) to evaluate mediating effects. The analysis used 5,000 bootstrap resamples and a 95% confidence interval. The results of the mediation tests are summarized in **Table 11**. As shown in Table 10, none of the confidence intervals for the indirect paths contained zero, confirming that all mediating effects in the structural equation model were statistically significant.

Table 11. Results of the mediation effects.

Path	Point Estimates	SE	Bias-Corrected 95% CI			Percentile 95% CI		
			Lower	Upper	p	Lower	Upper	p
RS→SN→UI	0.307	0.123	0.144	0.666	0.002	0.123	0.600	0.004
RS→AB→UI	0.288	0.151	0.087	0.723	0.010	0.064	0.660	0.018
RS→PEC→UI	0.196	0.096	0.070	0.486	0.003	0.048	0.414	0.009
SSUT→PEC→UI	-0.248	0.167	-0.687	-0.056	0.005	-0.597	-0.035	0.011

4. DISCUSSION

4.1 Old Adults Signify the Acceptance of Battery Rickshaw:

Table 12 shows that adults over 35 are more likely to use battery rickshaws, likely due to perceptions that public transit is cumbersome and overcrowded and to a stronger need for dependable first and last mile connectivity.

Table 12. The mean comparison of sharing knowledge and intention

	Variables	Practical Experience and Constraints			Usage Intention		
		Mean	SD	*t*-Test	Mean	SD	*t*-Test
Gender	Female	3.339	1.073	*t(112.2) = 0.269 p = 0.7884*	2.479	1.091	*t(104.9)= -0.872, p= 0.3850*
	Male	3.294	1.059		2.625	0.998	
Age	Younger (≤35 years)	3.289	1.040	*t(14.4) = -0.687 p = 0.5030*	2.630	1.015	*t(15.2)= 2.433 p= 0.0277*
	Older (>35 years)	3.536	1.308		1.946	1.010	
Monthly Household Income	Low Income (<70k)	3.327	1.082	*t(62.2) = 0.490 p = 0.6257*	2.617	1.003	*t(53.4)= 0.951 p= 0.3460*
	High Income (≥70k)	3.237	0.985		2.428	1.119	
Primary Travel Mode	Public Transit	3.308	1.040	*t(158.0) = -0.001 p = 0.9991*	2.603	1.016	*t(156.5) = -0.261 p= 0.7945*
	Others	3.308	1.079		2.562	1.039	
Personal Vehicle Ownership	Yes	3.451	0.986	*t(98.9) = -1.181 p = 0.2402*	2.627	1.005	*t(84.6) = 1.005 p= 0.3178*
	No	3.254	1.086		2.451	1.085	
Battery Rickshaw Travel Frequency	Frequently (At least once a week)	3.332	1.026	*t(141.6) = 0.373 p = 0.7094*	2.617	1.012	*t(146.6) = 0.638 p= 0.5248*
	Not Frequently (Less than once a week)	3.271	1.119		2.517	1.056	

4.2 Influences on User Intention to Adopt Battery Rickshaws:

Favorable attitudes toward this mode positively influence the intention to choose battery rickshaws as an alternative to other regular paratransit. As Dhaka is an emerging city with newly introduced MRT, an elevated expressway, and additional projects underway, overall mobility and travel speed are gradually increasing. Those who cannot afford a private vehicle often opt for battery rickshaws due to their time efficiency and cost-effectiveness. Moreover, the city's intense daily traffic produces substantial noise and air pollution; consequently, users who perceive battery rickshaws as generating lower emissions and noise consider them a convenient choice. Dhaka also contains about 25% roads of narrow width (Mahmud et al., 2009), locally termed "goli", where conventional public transport is infeasible; many travelers prefer door-to-door service with speed, further motivating the selection of battery rickshaws. To secure speed, time, and cost efficiency in one option, people are increasingly inclined to self-promote battery rickshaws, which brings subjective norms. Subjective norm is a person's perception of the social expectations to adopt a particular behavior (Peters et al., 2010). acceptance shows that recommendations from family and friends strongly influence user intention, indicating that both personal dispositions and external approval shape acceptance; indeed, family and peer endorsements can be decisive for behavioral intention. However, although many riders prioritize perceived speed, this surface-level appeal can obscure safety shortcomings. Beyond the dynamics of a rapidly evolving city, Dhaka still contends with heterogeneous traffic on main corridors where large buses and paratransit vehicles share the same space, creating safety risks. In addition, locally charged, improvised battery packs can raise user concerns. These experiences dampen battery rickshaw usage; nevertheless, they also suggest that adoption is likely to increase if safety standards, charging practices, and corridor management are improved.

4.3 Influences on Road Sharing in Dhaka's Mixed Traffic:

As mentioned earlier, Dhaka's heterogeneous mix of heavy and small non-motorized vehicles creates notable safety concerns. Individuals who have experienced safety incidents or charging-related problems are more likely to avoid sharing the road with battery rickshaws. The rapid proliferation of battery-driven rickshaws, often operated by unlicensed or inexperienced drivers, further heightens perceived risk, fostering fear among other drivers and pedestrians. However, those who recognize the advantages of environmental and affordability report a greater willingness to share road space with them. Moreover, individuals who are more susceptible to social influence (subjective norms) display more favorable intentions toward road sharing and using battery rickshaws.

4.4 Policy, Regulation, and Public Acceptance:

Although users with adverse experiences currently avoid selecting battery rickshaws as a routine mode, many would reconsider if sustainable adoption measures and clear policy frameworks were implemented. Environmentally conscious Dhaka residents are already inclined to choose battery rickshaws over other paratransit options; moreover, formal government regulation and enforcement would further increase willingness to adopt this mode.

4.5 Indirect Effects on Usage Intention:

Drawing on **Table 9**, road sharing is associated with higher usage intention when everyday experience is smoother, that is, when practical hassles are lower, and when it is accompanied by favorable attitudes toward the battery-driven rickshaw and perceived social approval. By contrast, respondents who advocate strong policy and regulatory frameworks exhibit lower usage intention, likely because their day-to-day experience is more hassle laden.

5. CONCLUSION

This study examined the determinants of battery rickshaw adoption in Dhaka by integrating behavioral components from the Theory of Planned Behavior with contextual factors such as practical constraints and road-sharing perceptions. The results indicate that attitudes and subjective norms are the strongest positive predictors of usage intention, with personal evaluations and social support from family and peers playing key roles. In contrast, safety concerns and charging-related issues negatively affect intention, highlighting operational barriers that hinder wider acceptance.

Road-sharing perceptions were found to indirectly influence acceptance, favorable views of sharing urban space with battery rickshaws strengthen social support and user attitudes while reducing perceived constraints. Similarly, support for sustainable urban transport improves perceptions of fewer obstacles, suggesting that environmental awareness can moderate acceptance by easing perceived challenges.

Dhaka's heterogeneous traffic mix increases crash risk for drivers, passengers, and pedestrians. Rather than an outright ban, access to primary arterials should be restricted with battery rickshaws prioritized on secondary streets and designated feeder routes. Charging stations should be legalized and standardized, and factory-produced, certified batteries should replace informal, locally assembled units. While the sector can alleviate unemployment through driving, maintenance, and battery manufacturing jobs, unchecked fleet growth may worsen congestion. To strengthen a transit-first strategy, battery rickshaws should serve as first/last-mile feeders, supported by multimodal hubs near MRT/bus stations. Complementary measures like licensing, periodic training, and routine enforcement can enhance the system's safety, security, and economic viability.

While this study advances understanding of user acceptance, it is limited by underrepresentation of low-income groups due to online sampling. Future research should employ longitudinal and mixed method approaches across varied urban contexts, incorporating economic, policy, and infrastructural factors alongside objective measures of traffic, safety, and environmental performance.

DECLARATION OF USE OF AI

The authors declare that AI-assisted tools were used solely for language editing to improve clarity and academic presentation. These tools were not used for data analysis, interpretation, or decision-making, and all scientific content remains the responsibility of the authors.

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