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Assessing Service Quality of Bike Sharing Service within Kathmandu Valley

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Abstract

Embracing a sustainable transportation paradigm requires a shift towards more eco –friendly modes of travel such as bike sharing services like Pathao & Indrive, Introducing a potentially disruptive and beneficial change to the transportation landscape in Nepal, bike-sharing hold a significant presence in Kathmandu, evidenced by their daily ridership and public recognition. Being a comparatively new concept, its service assessment becomes critical for the persistence of the facility. Perceived service quality assessment is a result of convoluted decision making process which require careful considerations of various factors including observed and unobserved variables. The study focuses on evaluating the service quality of Pathao & Indrive bike service employing the concept of structural equation modeling through the identification of unobserved influencing factors. Six latent variables were identified through factor analysis. An empirical model was developed to identify the interactions among major variables affecting service quality. SPSS 22 and SPSS Amos 21 were used for model development. The findings of the study presented that, the variable that have significant effect on service quality, was user's safety followed by latent variables service accessibility & application efficiency. The study will provide practical insights to these services to enhance their effectiveness and usability making the service more acceptable. It will also provide clarity in understanding to inform adoption of suitable policy decisions.

Keywords: Pathao, Indrive, SPSS, Amos, Factor Analysis, Ride Sharing, Latent Variables

1. Introduction

Bike sharing service is an act of organizing transportation in a private bike driven by its owner or driver on rent for a fee, with the help of a website or applications for a few hours or less. Customers can request rides through application installed in their mobile phones by selecting the pickup and drop-off locations. The app shows the location of rider as well as the user who requested the ride along with the estimated fare. It also shows the route traversed by the rider while coming to pick up the user. Ride reservation and account is managed through application. Payment can be done manually or through an online application like mobile banking e-sewa, etc. The user friendly interface and ease of choosing the destination gives an additional benefit to the customer (Wali et al., 2017). As a bike sharing platform, motorbike service was launched in Bangladesh which quickly gained popular over time. In Nepal bike sharing service started with the development of Tootle application by Sixit Bhatta in 2017 which brought a new concept of sharing bikes on rent. After that Pathao was started as a bike sharing platform. There are many ride sharing applications which are used in Nepal. For eg. Pathao, Tootle, Sahara, Indrive, Taximandu etc. Among them the two most popular bike sharing platform are Indrive & Pathao. From tiny operation, the company has grown to become one of the most important bike sharing companies in Nepal over the years. In Nepal, Pathao was started on September 25, 2018, in Kathmandu and Indrive was started in April 2022. In the present day, both of this application provide bike as well as taxi service. The bike sharing service is more prominent transportation service among the service provided by them. It has been evolved as a creator of employment opportunities. It enables individuals with their own vehicles to become riders which empower people owing

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bikes cars to sign up as drivers and provide transportation services to users. These drivers can earn by providing rides to passengers. Besides riding service, it also provides facilities of food delivery, parcel and e-commerce. In Kathmandu Valley, especially in the central part of the city, people face more crowd and congestion. It's very prevalent to see numerous bike riders waiting for ride request from passengers. Many of them even refuse to take requests through the ride sharing app either because of the long distance or to avoid paying commissions to the ride sharing company for keeping more of their earning within themselves. Service quality is crucial parameter in planning a transportation service, its enhancement for the betterment of the service company as well the users. Passenger's experience in ride sharing is significant in determining how frequently they will use these services (Islam et al, 2022). However, the bike sharing business, much like others in Nepal, lacks transparency, and there is very little data in public domain. Very few researches have been conducted on the service quality of this bike sharing service in case of Nepal. The increasing number of Pathao & Indrive bike users raises a question about its service quality. There are different methods for service quality measurement, SERVEQUAL, Post Visit ratings, Follow Up Surveys, Customer Satisfaction Score, Customer effort scores. Structural Equation Modeling (SEM) is used in this study to assess the service quality because of its capability to handle complex relationships. It is a multivariate statistical technique that is used to analyze complex relationships between observed and latent (unobserved) variables. It can handle multiple variables and provides information on the effects within the model which can be direct or indirect. Mohaimenul et al (2022) presented a structural equation model justifying the acceptance of ride sharing by people.

SEM model has two components, the measurement model and structural equation model. Both of them explain the relationship between latent variables and their corresponding observed indicators. Latent variables are theoretical constructs that cannot be directly observed but are inferred from observed indicators, which are measurable variables that are thought to reflect the underlying constructs. The coefficients called factor loadings represent the strength of the relationship between each observed indicator and its corresponding latent variable. The relationship between dependent and independent variable is demonstrated by the equations given by these model. The main objective of the study is to assess the service quality of bike sharing service within the Kathmandu by addressing various service quality dimensions in the form of observed and latent variables.

2. Literature Review

Service quality measurement is critical in transportation services. Passenger perceptions provide valuable insights about how customers perceive and interpret the quality of transportation services. Measuring service quality based on customer's perception helps in identifying areas for improvement to build customer satisfaction. Satisfied customers are more likely to become repeat users and recommend the service to others. It is essential for enhancing operational efficiency complying with regulatory standards. Since, the number of Pathao and Indrive service users is increasing rapidly in Kathmandu Valley, the study of the factors in the form of variables is required. Many researches have been conducted using SEM for measuring service quality of transportation services.

Laura et al (2012) used SEM approach for analyzing passenger's perception in terms of satisfaction with transit services. A SEM model was formulated to explore the impact of the relationship between global customer satisfaction and service quality features such as safety, cleanliness, main and additional services, information and personnel. The latent variables with the highest positive effect on service quality were service and cleanliness. The study concluded that the weight that passengers give to each of the attributes, and the measure of their satisfaction helped in improving service quality and preparing for better investment plans. Shrestha (2007) studied the travel behavior of people in Bangkok through Structural Equation Modeling. The result showed that personal safety and comfort factor had positive relationship with gender age, education, car, ownership and trip purpose. People put more value on safety and comfort. Negative relationship was found with occupation.

Mohaimenul et al. (2021) studied the acceptance of ride sharing service by structural equation modeling. The study developed a structure model to identify the ride sharing service acceptance of people and their perceived

risk. The result showed that safety and security of ride sharing service and user's judgement in the developed model have positive influence with each other. Personal safety had negative influence with women's safety.

Nishatee et al. (2020) conducted a case study on Pathao bike service. SEM was employed for developing an empirical model to identify relationships among major variables affecting the service quality of Pathao Bike service in Dhaka. The study used sixteen observed variables, ie Riding Safety, Riding Comfortability, Cleanliness, Driving Skill, Vehicle Quality, Female Security, Driver's Behaviour, Comfort with Drivers, Destination Display System, System upgradation, System Availability, Customer Care Service, Trip Completion, Responsiveness, Credibillity of Billings & Rate of Fare and two latent variables. "Service Feature" and System Performance" were analyzed.

Paulus et al (2015) conducted research examining the relationships between land use and travel behavior, based on data from Tyne and Wear, North East England to gain a better understanding of the mechanism by which variation in changes in travel behavior were explained. The paper demonstrated that changes in public transport use and walking were determined by four dimensions of the conceptual framework, in particular, the linkages between the neighborhood characteristics and travel behavior.

3. Research Methodology

The objective of the study was to assess the service quality of bike sharing service within the Kathmandu valley by addressing various service quality dimensions in the form of observed and latent variables. The methodology was focused on factors that can affect service quality of bike sharing service.. A three step methodology was used for the research work. First step aimed at selection of service quality variables, second step provided the data collection and data sorting for different data testing and the last step gave the structural equation models to utilize this study. The study area was selected as Kathmandu Valley. The most concentrated area was RNAC where most of the data were collected.

3.1 Sample Size

There are few rule of thumb guidelines to consider when working with SEM. It aims for a sample size of at least 200 to 250 participants, and ideally, aim for a higher sample size if the model is complex or involves a significant number of latent variables. In this study, for the determination of sample size, a simple random sampling method was used for data collection. Levy and Lemeshow (2008) gave an empirical formula assuming the population to be normally distributed for the determination of sample size,

$$\text{No} = \frac{Z^2 pq}{e^2} \qquad \text{(Equation1)}$$

Where, no =Sample size for infinite population
Z= Statistical parameter corresponding to confidence level (Z is 1.96 for 95% confidence interval)
e=Desired margin of error (adopted as 5%)
p=Hypothesized true proportion for population (adopted as 0.5 to account for the worst case)
q=1-p
Inserting these values in eqn 1, we get no=384.16.
For the study, the responses of 503 participants were considered for model development.

3.2 Selection of variables

A pilot survey was conducted at first for the selection of variables between customers as well as riders. The variables which were of most important to the users and rider were taken for questionnaire survey. The classification and description of various service quality variables are included in Table 1.

3.3 Design of Questionnaire

The questionnaire survey was structured into four sections. The first section included queries related to demographic characteristics (gender, age, occupation, travel characteristics, purpose of travelling, and frequency of using the service. The second section was oriented to the collection of passenger opinion about

different service quality variables. The third section consisted of overall service quality. Five point Likert scale was used from 1=Very Poor, 2=Poor, 3=Average, 4=Good to 5=Very Good.

Table 1. Classification & Description of Service Quality Variables

Variable name	Symbol
Bike availability	BA
User friendly	UF
Easy to book a trip	EBT
Bike availability on time	BAT
Reaching destination as per expected time	RDET
Less waiting time	LWT
Condition of seats	CS
Condition of mirror and brakes	CMB
Driver's skill	DS
Driver's behaviour	DB
Defensive driving	DD
Managing speed	MS
Patience	PAT
24/7 customer support	CSU
Real-time GPS tracking	RGT
Live location sharing	LLS
Door to door service	DDS
Waiting charge	WC
Deception	DEC
User security	US
Safety from accidents during riding	SFA
Safety from theft	SFT

3.4 Data Collection & Analysis

The data was collected manually as well as through Google forms to reach a large mass of people. Road side interviews were taken for the collection of maximum data. The questionnaire, was distributed among the users. They were explained about the importance of this survey. It was explained in order to lessen the confusion among the users. The data was sorted into Excel and then into SPSS. Reliability test was done in SPSS which measures of consistency of the data given by Cronbach's Alpha test. It assessed how closely related a set of items as a group, with the goal of determining whether they measured the same underlying construct or concept. Cronbach's Alpha provides a numerical value between 0 and 1, where higher values indicate greater internal consistency. Confirmatory Factor Analysis (CFA) was done to reduce the number of observed variable by grouping them into smaller group based upon the inter-relationships between variables. Altogether 39 variables was reduced to 22 variables based upon the integrity between the variables. KMO and Barlett's test was done for dimensionality reduction. They were performed for the suitability of data for factor analysis and to evaluate whether the observed variables are suitable for this type of analysis. The KMO test assessed the adequacy of the data for factor analysis. It checks whether the data's structure is suitable for extracting underlying factors. It produces a statistic between 0 and 1, where higher values indicate a better suitability for factor analysis. The model was fitted and validated after number of trial in Amos 21. Two types of model were developed; measurement model and main structure equation model. The goodness of fit of the model was given by different measures.

4. Result Analysis & Interpretation

From preliminary data analysis, it was found that about 74% of the respondents were male and only 26% of the respondents were female indicating less concentration of female over choosing bike sharing as a transportation service compared to male population. Majority of the respondents belonged to age group 21-35 years with major of users being students. The reliability statistics is as presented in table 2.

Table 2. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items
0.933	0.935

The Chronbach's alpha value was found to be 0.933 which suggested that the items in the questionnaire or scale being measured are highly internally consistent, meaning they likely measure the same underlying construct.

4.1 Factor Analysis

Factor analysis was done to reduced large number of variables into smaller number based on their importance to measure the underlying construct. The results of factor analysis are presented in table 3.

Table 3. Factor Analysis Result

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.897
Bartlett's Test of Sphericity	Approx. Chi-Square	4133.77
	df	231
	Sig.	.000

A KMO value was found to be 0.897 which was relatively high indicating that data was well suited for factor analysis. The test result shows a chi-square value of 4133.770 with 231 degrees of freedom (df) and a significance level of 0.000. A significant result ($p<0.05$) in Bartlett's test suggested that the correlation matrix among the variables was statically significant, which again supports the suitability of the data for factor analysis or SEM.

4.2 Model Development

Confirmatory factor analysis was carried out by the formulation of a measurement model. The measurement model underwent rigorous refinement through series of trial obtain the best final structural equation model which fit the data. It showed the relationship of variables with each other considering different factors. The measurement model consisted of six latent variables. The observed variables are represented by rectangles and latent variables by ellipses. The latent variables were named according to the description of the observed variables. The measurement model is as presented in figure 1.

The latent variables are named so that it clearly reflects the underlying construct. From the figure, the latent variable "Driving Competency" (DC) was measured by the observed variables Managing speed, Defensive driving, Patience, Driver's skill, Driver's Behaviour. "Service Accessibility"(SA) is measured by Live Location Sharing, Real Time GPS Tracking, Door to Door Service, 24/7 Customer Support. "Trip Efficiency"(TE) was measured by Reaching Destination As Per Expected Time, Bike Availability in Time, Less Waiting Time, Condition of Seats, Condition of Mirror & Brakes. "User Safety" (USAFT) was represented by the observed variables Safety from Theft, Safety from Accidents, User's Security. "Application Efficiency"(AE) was measured by the variables User Friendly, Bike Availability & Easy to book Trip. "Trustworthy"(TW) was represented by Deception & Waiting Charge. The measurement model was fit and valid in Amos. After the series of trial with measurement model, the variables which positively affect service quality was taken into final structural equation model by rejecting the variables which negatively affect overall service quality. The structural equation model is shown below:

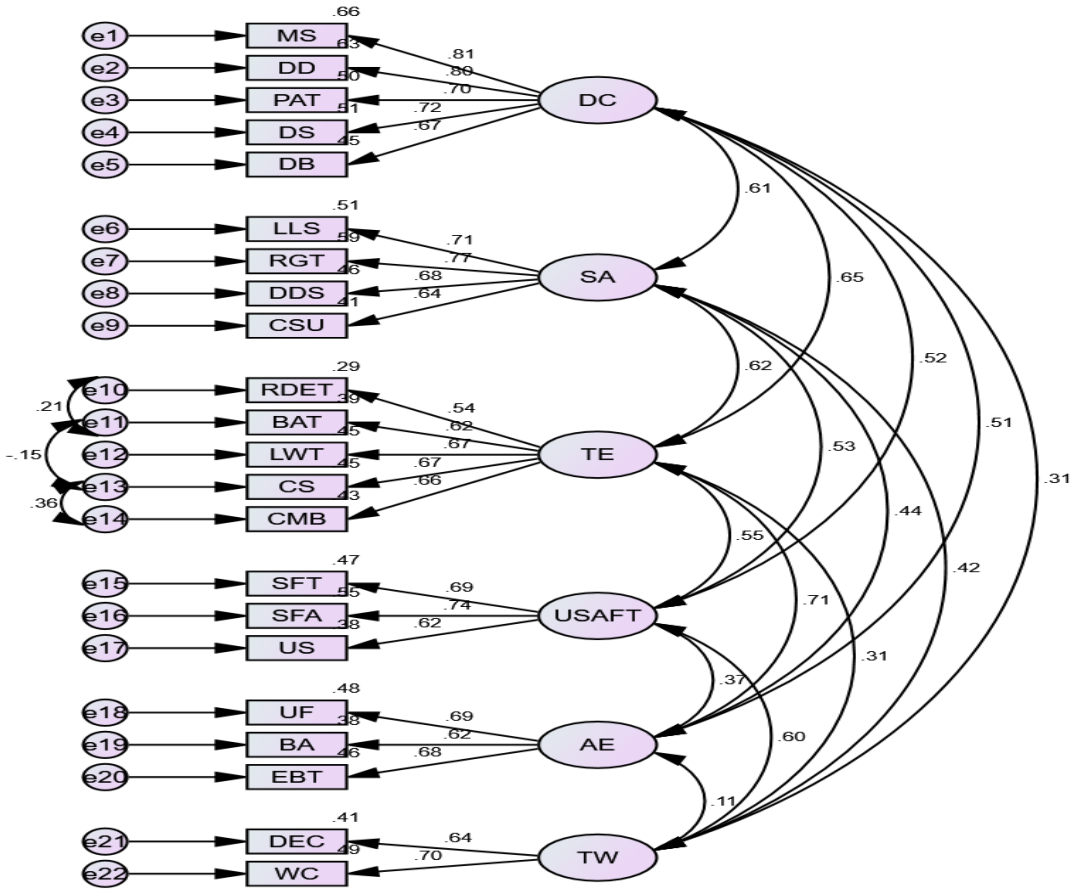

Figure 1. Measurement Model

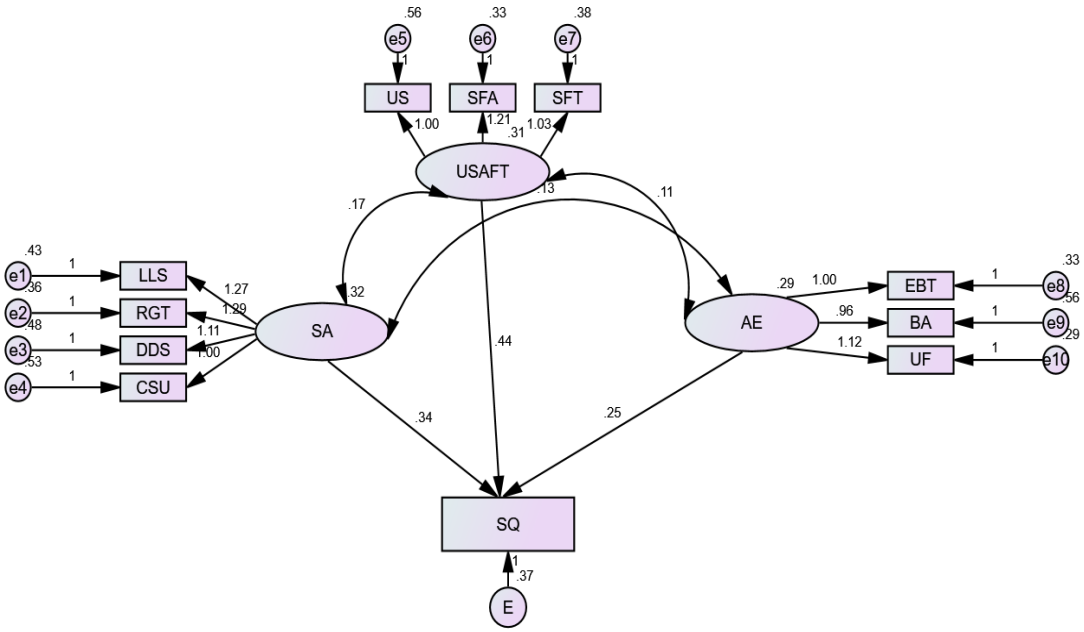

Figure 2. Structural Equation Model

Equations used in this model are:

From the structure following equation can be written:

$$Z=A+\alpha\eta+E$$

$$X=\lambda\eta+e$$

Where, Z = Overall Service Quality (SQ).

A = Constant value (also known as an intercept which helps in model identification)

E & e = measurement error in Z and X respectively.

X represented the observed variable, η = the latent variable influenced by observed variable &. α, λ represents coefficients of Z & X respectively.

4.3 Model Result Interpretation

The results of the model is as presented in Table 4.

Table 4. Model Result

Latent Variable	Observed Variables	Estimate	t-value	p-value
USAFT	US	1		
	SFA	1.208	10.934	***
	SFT	1.026	10.595	***
SA	CSU	1		
	DDS	1.112	11.553	***
	RGT	1.290	12.559	***
	LLS	1.270	12.290	***
AE	EBT	1		
	BA	0.961	9.603	***
	UF	1.116	10.442	***
Observed Variable	Latent Variable			
SQ	USAFT	0.441	5.304	***
	AE	0.249	3.261	0.001
	SA	0.344	4.293	***

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

Almost all the variables are significant in two tailed t test with critical value of 1.96 for 95% confidence interval. By observing the magnitude of factor loadings on each service quality variables, it can be seen that the latent variables user's safety, service accessibility & application efficiency are best explained by the observed variables safety from accidents, real time GPS tracking and user friendly respectively. The latent variable which have higher influence on overall service quality is user safety followed by service accessibility and application efficiency. The study reveals that individuals involved in my research gives priority to real time GPS tracking in first place since it helps in knowing the accurate location of the rider throughout the journey. The accurate location information for both riders/ drivers and customers helps minimize the errors in pickup and drop-off locations, reducing confusion, and improving the overall experience. The user's friendly interface is fundamental in attracting and retaining customers. The safety of user is the most important parameter in any passenger transportation service ensuring customers reach their destination safely. Most of the latent variables had positive correlation between each other which can be seen in final structure equation model.

The model was fit with Cmin/df value 2.024, RMR value 0.026, RMSEA 0.045 and the value of GFI was 0.973. The model validation was done with the help of composite reliability, convergent validity, discriminant validity, and average variance estimation. From the model validation table, we observe that almost all latent

construct have considerable composite reliability close to 0.7. The average variance extracted (AVE) was valid since CR is greater than 0.6 (Fornell and David, 1981). AVE was greater than MSV (Maximum shared variance) and the square root of AVE was greater than inter construct correlations.

Table 5. Model Validation

Latent Variable	CR	AVE	MSV	Max(R(H)	USAFT	SA	AE
USAFT	0.691	0.376	0.280	0.745	0.613		
SA	0.759	0.407	0.280	0.807	0.529	0.638	
AE	0.639	0.341	0.184	0.721	0.356	0.428	0.584

5. Conclusion and Recommendations:

The study explored the variables that affects the overall service quality of Pathao and Indrive bike service. Since this application- based bike- sharing transportation service is excessively used these days by every age groups, occupation at any time so the proper study of its service quality based on customer's perception becomes necessary for proper policy making and for enhancement of the transportation service. From the study, among the six latent variables, driving competency, service accessibility, trip efficiency, user's safety, application efficiency and trustworthy only three latent variable application efficiency, service accessibility and user's safety was found to influence overall service quality positively. The user's safety has greatest influence measured by variables safety from theft, safety from accidents and user's security from breaching their personal information. Customer's preferred to service accessibility measured by live location sharing, real time GPS tracking door to door service and 24/7 customer support. Being an application based bike sharing service, application efficiency was also found to be important measured by variables user friendly, bike availability and easy to book trip. Data on station distribution, bike availability identify the deserved areas and improve access to the service. Analyzing the user's report, safety campaigns can be targeted in specific areas and risk hotspots that foster infrastructure improvements. Monitoring app usage, response times helps in simplifying the process and improve user's experience. Based on traffic patterns, customer's demand and safety risks, dedicated bike lanes, improved intersections can be developed. By effectively analyzing and utilizing data on service accessibility, user's safety and application efficiency, policymakers can plan and implement strategies that create more robust, sustainable and user friendly bike-sharing ecosystem for both Pathao and Indrive, benefitting individuals, businesses and environment.

The study can be extended by exploring the moderating variables with the investigation of factors like user demographics (age, income) or trip purpose (work commute, leisure) influencing the relationship between service quality dimensions and overall satisfaction. Advanced SEM techniques like partial least squares (PLS) SEM can be used which can handle smaller sample sizes or non-normal data, common in survey research.

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