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Passengers' Perception towards Quality of Public Transportation Services in Kathmandu Valley

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Abstract
The increasing modal shift from public to private vehicles in Kathmandu Valley is not only a regional traffic issue but is also alarming for the sustainable growth of the whole nation. Modal shift intentions are only controllable if service quality issues are properly identified and addressed. This paper presents a detailed study on passengers' perception towards quality of public transportation services in Kathmandu Valley and helps to identify a prioritized list of areas that requires immediate improvement. SERVQUAL (Service Quality) model based on RECSA (Reliability, Extent of service, Comfort, Safety and Affordability) quality aspects is used for the analysis of the quality of existing public transportation services. The model compares passengers' expectation and perception on various quality domains and identifies the areas of notable gap. Analysis of passengers' responses shows significant gaps between their expectations and perceptions in all five quality aspects of the services. Kruskall-Wallis H test and Mann-Witney U test shows that there is significant difference in gap among safety and affordability dimension with respect to reliability, extent of service and comfort.

Keywords
Public transportation, service quality, gap analysis

1. Introduction

Kathmandu is the busiest city of Nepal with increasing population[1], density and motorization [2]. Existing facilities doesn't seem to cope with the increase in traffic demand. Due to which problems like traffic congestion, crashes and pollution have become inevitable. High capacity public transport systems reduce congestion, air pollution, and increase fuel efficiency per passenger and influence urban space by providing transportation services to a large number of people. Space required to transport the same amount of people with bus is much smaller than that with private vehicles.

There are a wide range of public transportation services provided in Kathmandu like bus, micro, tempo (three-wheeler). Most of them runs to over capacity at rush hours [3], slow operation during other hours and have informal fare collecting system (no ticketing system) and do not seem to be an attractive mode to the users. There are guidelines and manual (code of conduct) provided by DOTM [4, 5] regarding bus structure, safety inside vehicle, safety for women, discount, fare, information, in time reach to destination, etc. but enforcement seem to be an issue. The number of two wheelers are highly increasing with a record of increase of 81%, while the increase of public transport vehicle (bus, micro, tempo, minibus) for the same year is only 2% (DOTM, 2018) in Provision 3. Public transport services if not made attractive soon, the accelerated traffic demand and modal shift in the valley will make the traffic problems unmanageable. Therefore, there is a strong need of development of appropriate policies, incentives, and regulations to improve the public transportation services in Kathmandu, and this requires a proper understanding of user's expectations and perceptions regarding the existing system which is the major concern of this study.

Satisfied customers form the foundation of any successful business. So, to gain loyal public transportation users, their satisfaction must be maintained. Modal shift intentions are only controllable if service quality issues are identified and addressed. Limited studies have been conducted to investigate passenger perception towards public transport services in Kathmandu [6][7] and to the knowledge of the authors, none of the studies have

performed gap analysis of the passengers' expectations and experiences of the public transportation services in Nepal. This paper fills the gap in the literature and aims to perform a detailed study on passenger's perception towards quality of public transportation services in Kathmandu Valley, Nepal to identify a prioritized list of features that requires immediate improvements. This will assist service providers, service promotor, policy makers and government bodies in formulating plans and strategies to improve the current public transportation services in the valley.

The rest of the paper is divided into five sections. Section 2 discusses the review of relevant literatures. Section 3 describes methodological approach of the study, and provides details of the case study area and the analytical model. Section 4 presents results of analysis and section 5 concludes the findings of the study.

2. Literature Review

Different researchers have used different methods for evaluating public transportation services. Raoniar [8] provides an extensive survey of various models used in literature for evaluating performance of public transport system. SERVQUAL (Service Quality) Model, Impact Score Technique, Important Performance Analysis, Customer Satisfaction Index, Structural Equation Modeling (SEM), Ordered Logit Mode and Soft Computing Techniques have been used in the past for evaluating public transportation services.

Structural Equation Modeling (SEM) methodology is a multivariate analysis technique in which a causal relations between several variables are established. Researchers [9, 10] used SEM model to find the structural relationship between service quality, customer satisfaction, passengers' safety behavior, environmental sustainability , behavioral intentions and other service terms.

The impact score technique approach determines the relative impact of attributes on passenger satisfaction by measuring relative decrease in user satisfaction when there is a problem with the attributes. Alçura[11] determined the most problematic areas of the service provided by the high-speed railway system (HSRS) using impact score technique with seven dimensions of service quality: passenger information, fare level and type, accessibility, station environment, vehicle environment, service delivery, and security.

Customer Satisfaction Score (CSAT) measures on average, how satisfied or unsatisfied customers are with the service provided. Karki[6] used customer satisfaction index to access the service quality of public transport services in Kathmandu and found that peak hour service frequency and service reliability were of poor service quality.

Susilawati[12] uses comfort, responsiveness, capacity, tangible, safety, and reliability to determine customer satisfaction using factor analysis. Joewono[13] explains the perception of users and non-users, concerning safety and security of paratransit and was analyzed by applying the factor analysis.

The SERVQUAL (service quality gap model) measures the gap between customer's expectations and their perceptions of the actual service experienced. Various researchers in literatures used SERVQUAL models for evaluating the performance of public transportation services. Alberto [14] evaluated the quality in the transportation service in Morelia, Mexico using adapted the SERVQUAL model, consisting of 6 variables (Reliability, Responsiveness, Assurance, Empathy and Tangibles) and 24 items. Horsu[15] used SERVQUAL model with RECSA dimensions, (Reliability, Extent of service, comfort, safety, affordability) to determine the influence of service quality on customer satisfaction of minicab. In India, kumar[16] applied the SERVUAL model to measure perceptions and expectations of bus passengers in Tamil Nadu and found no significant differences between perceptions and expectations of all service attributes. Mikhaylov[17], used SERVQUAL model to discover the quality gap of customers' expectations and perceptions on public transportation services and found that service environment, which includes the tangibles dimension, received the largest expectations-perceptions' gap. Luke[18] used an adapted SERVQUAL model, applying five dimensions of service quality, RECSA. They used the SERVQUAL model to ascertain the service quality and customer satisfaction of selected commuter services. The results reflect that safety concerns,particularly in terms of crime prevention and reliability are most concern among most modes of transport.

Different researcher used different model as well as different variables of service quality. Most of the method are based on only perception of passenger but

SERVQUAL was able to measure expectation as well as perception which assists in ranking the area requiring the most improvement. This may help the planner to allocate the resource for improvement to the most unsatisfied area. Variables in this study are defined considering the variables used in the above literatures and considering the specificities of the case study location. SERVQUAL model with RECSA dimension seems to accommodate all these service attributes applicable to Kathmandu, so this model is used in our research.

3. Methodology

Figure 1 shows methodological framework of this study which starts with review of the different relevant literature to identify the most appropriate method and variables for evaluating public transportation in Kathmandu Valley. SERVQUAL model or service quality gap model is considered for evaluation of the quality of public transportation services which is further discussed in following subsections.

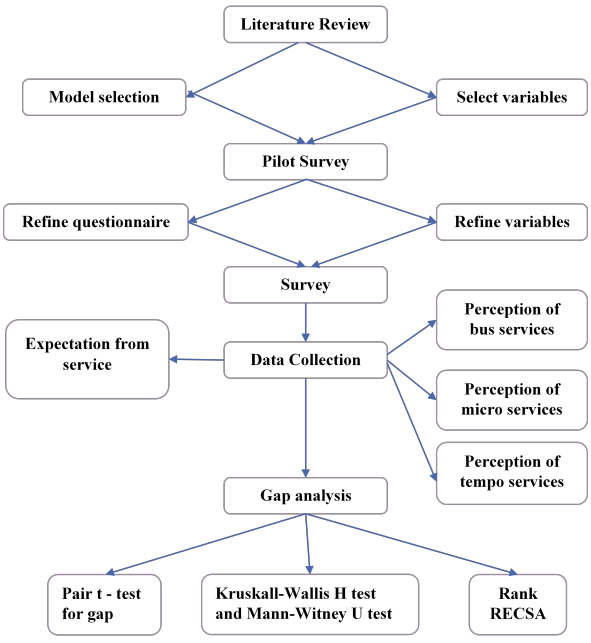

Figure 1: Flow chart of the research methodology

3.1 Study area

Kathmandu Valley includes three major urban cities of Nepal, the capital city Kathmandu, Lalitpur and Bhaktapur and has a population of 1,645,091 with density of 2793 per km^2 [1]. It is connected by the Tribhuvan Highway to the south connecting India, Prithvi Highway to the west and Araniko Highway to the north connecting China. Figure 2 shows the map of the study area.

Figure 2: Map of Kathmandu valley
(Source : Google map)

At present, public transportation in Kathmandu Valley is provided by buses, mini buses, micro buses, and tempos. Bus and minibuses serve on major roads while micro buses, and tempo serve both major and secondary roads. The public transport services have been provided by several private operators. As detailed in Table 1, with the latest data available as of 2014, there are more than 5000 public vehicles operating over more than 200 routes in the valley.

Table 1: Public transport services operational in Kathmandu Valley

Types of Public Transport	Passenger Capacity	Number of Operation Route	Number of Operating Vehicles
Tempo	11-13	21	913
Micro bus	10-16	90	2,036
Minibus	26-35	107	2,036
Large bus	35-50	4	336
Total		222	5,321

(Source: CANN[19], 2014)

3.2 SERVQUAL Model

SERVQUAL is a research tool that measures users expectation and perception towards quality of a service under multiple number of dimensions. It further allows statistical and qualitative analysis of the quality of services offered for which various researchers have used gap analysis and other

statistical analysis.The According to Parasuraman et al. (1985), service quality, which is the function of perception and expectation, can be modeled as given in equation 1.

$$SQ_i = \sum_{j=1}^{n} (P_{ij} - E_{ij}) \quad (1)$$

Where, SQ_i is Overall perceived service quality by individual i, P_{ij} is Perception of individual i with respect to service attribute j, E_{ij} is Expectation of individual i with respect to service attribute j, and n:Number of attributes.

In this study, the service quality analysis was performed based on the five dimensions: Reliability, Extent of service, comfort, safety, affordability widely known as RECSA that represents service quality.The quality aspect reliability is a measure of ability to perform the promised service dependably and accurately. Extent of service considers the range of services covered both in geographical and time aspect. Comfort refers the state or situation in which one feels relaxed and do not have any physically unpleasant feelings. S stands for safety and security measures to evaluate the likelihood that passengers to be involved in vehicular crashes or become a victim of crimes such as harassment and being theft.

Figure 3 shows the various attributes identified under each of the five aspects to evaluate the quality of public transportation services in Kathmandu Valley. The attributes are defined with reference to various relevant literature and most importantly considering specificities of the case study problem. As shown in the figure, four different attributes relating to reliability, six attributes relating to comfort, five attributes relating to extent of service, four relating to safety and three relating to affordability have been identified for the case study problem. Considering respondant travel to different locations inside Kathandu valley, they are able to response to our questionnaire survey in terms of responder's agreement to the need/provision of the mentioned attribute in 1 (Not agree) to 5 (strongly agree) scale.

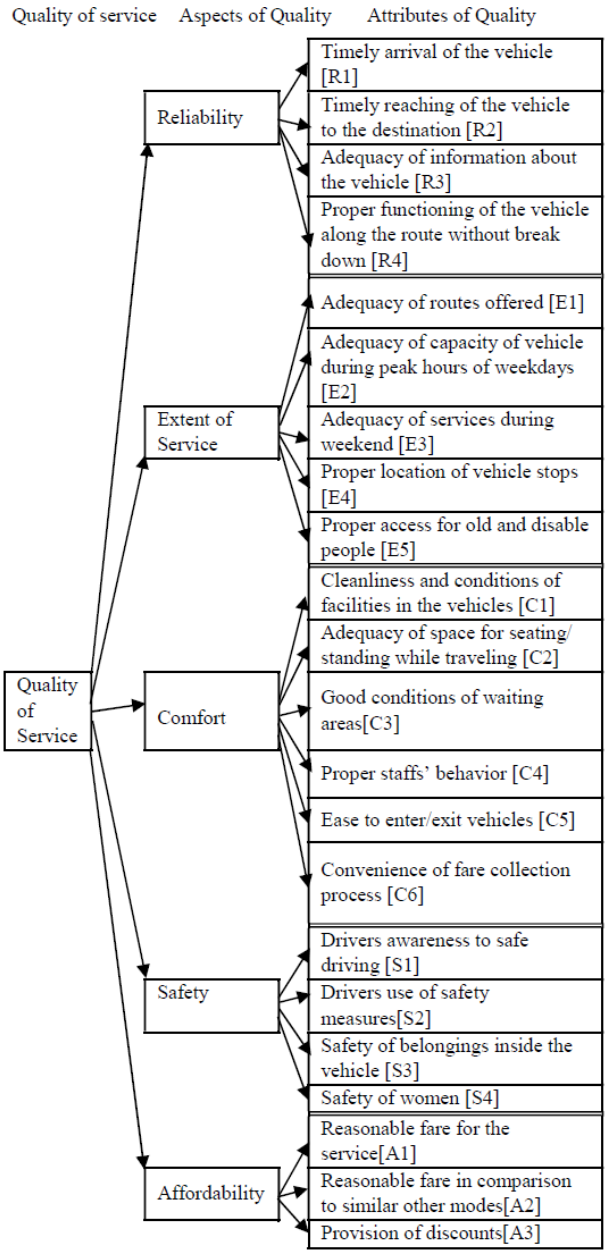

Figure 3: Service attributes considered

3.3 Survey

A pilot survey with 35 respondents was conducted initially to improve the clarity, validity and elements of the survey questionnaire. The questionnaire was then refined and final version of questionnaire was translated in Nepali and was used for conducting a

large scale questionnaire survey covering different groups of passengers. The data collection was carried out in June and August, 2021 from different public transportation users. Data were collected both directly that is with face to face interview from sources like while travelling, at bus stops, from work and by using indirect ways such as through telephonic interviews, and online and offline fill out forms. The telephonic interview was conducted to about 5% of respondent which mainly includes, public transportation users, acquaintance from different workplace for which form were first sent and information were collected. Literature on service quality analysis are considering sample size ranging from 150- 500. In this study, a total of 402 sample surveys were conducted of which 35% were conducted using direct methods while the rest 65% were collected from indirect methods. Average time taken by each respondent to answer all question was about 11 minutes.

The questionnaire comprises of three sections. The first section gathers basic information about the respondents (gender, age, occupation, own vehicle or not, frequency of usage of the public transportation service). The second section collects the respondents' service quality expectations in terms of the different parameters selected for evaluation and the third section measures the respondents' perceptions of the service quality actually provided. Passengers' perception was collected for the three major public transportation services in the Valley: bus, microbus and tempo (three-wheelers). The responses were collected in terms of responder's agreement to the need/provision of the mentioned attribute in 1 (Not agree) to 5 (strongly agree) scale.

4. Results and Discussion

Figure 4 shows the demographic characteristics of the respondents. As can be seen in the figures, the sample responses were collected to cover different passenger groups in terms of gender, age, employment, status of vehicle ownership, and types and frequency of public transportation services used. When asked "how frequent do you use public transportation?" 15 of the respondents answered "never", whose responses were not further considered in the analysis.

Statistical Package for Social Science SPSS Version 26 is used to process and analyze the data collected from the survey. The participants' service quality expectations are higher relative to their judgement of services offered resulting in negative gap scores for all the twenty two attributes considered in the study. Negative gap indicates peoples' dissatisfaction due to difference in their expectation and perception. Paired t-test was conducted to check if the gap scores obtained for different attributes are statistically significant or not. The test was conducted at a significance level of 5%, i.e. confidence level of 95%.

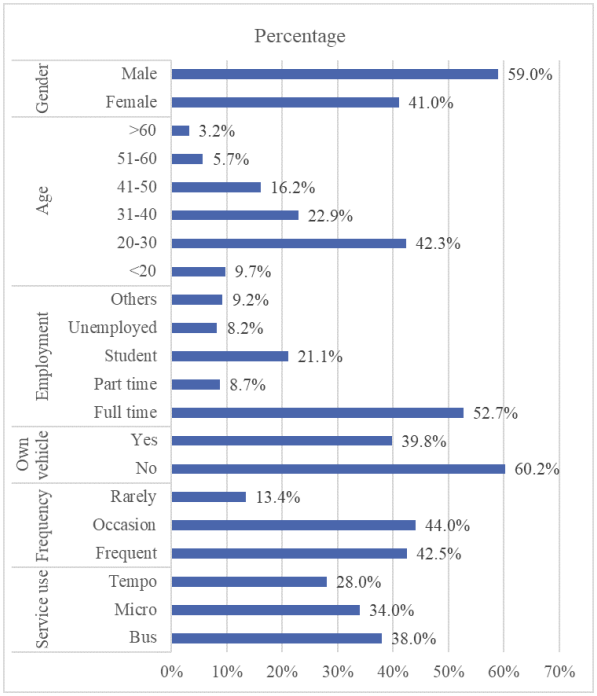

Figure 4: Demographic characteristics of the respondents

Table 2 shows the results of paired t-test conducted for the 22 RECSA parameters considered in this study for the public transportation services. The t values and their corresponding p values are given in the table. The test result shows that passengers' expectation and perception towards quality of public transportation services are significantly different for each of the 22 parameters considered with p values for all largely less than 0.05. This is based on the statistical test results. The values are not exactly zero but very small values. The average expectation and perception values and average gap are also given for each of the parameter. Service ID attributes with its service aspect are shown in figure 3.

Table 2: Passengers' expectation, perception and gap towards quality of public transportation services

Attributes ID	E	P	Gap (P-E)	t-value	p-value
Reliability					
R1	4.50	2.56	-1.94	30.5	0.00
R2	4.52	2.52	-2.00	32.6	0.00
R3	4.28	2.59	-1.69	27.0	0.00
R4	4.32	2.58	-1.73	26.4	0.00
Extent of Service					
E1	4.46	2.78	-1.68	28.8	0.00
E2	4.47	2.32	-2.15	35.3	0.00
E3	4.06	2.79	-1.27	18.0	0.00
E4	4.38	2.65	-1.73	26.7	0.00
E5	4.63	2.66	-1.97	31.6	0.00
Comfort					
C1	4.53	2.52	-2.01	31.5	0.00
C2	4.43	2.43	-2.00	33.2	0.00
C3	4.34	2.49	-1.85	29.1	0.00
C4	4.52	2.63	-1.89	31.8	0.00
C5	4.44	2.60	-1.84	29.6	0.00
C6	4.39	2.74	-1.65	26.5	0.00
Safety					
S1	4.60	2.63	-1.97	33.6	0.00
S2	4.51	2.39	-2.11	35.2	0.00
S3	4.46	2.36	-2.10	35.8	0.00
S4	4.62	2.45	-2.17	36.6	0.00
Affordability					
A1	4.34	2.64	-1.69	27.3	0.00
A2	4.24	2.79	-1.45	22.6	0.00
A3	4.06	2.85	-1.21	18.1	0.00

Table 3: Statistical differences between gap score in five dimensions

Test	Gap score		
Kruskal-Wallis H Test			
H-value	84.356		
Sig.	✓		
p-value	0.00		
Mann-Whitney U Test			
	Sig.	p-value	Ranking
R-E		0.169	
R-C		0.691	
R-S	✓	0.001	R<S
R-A	✓	0.000	R>A
E-C		0.065	
E-S	✓	0.000	E<S
E-A	✓	0.000	E> A
C-S	✓	0.003	C<S
C-A	✓	0.000	C>A
S-A	✓	0.000	S>A
*Significance of variance, p<0.05			

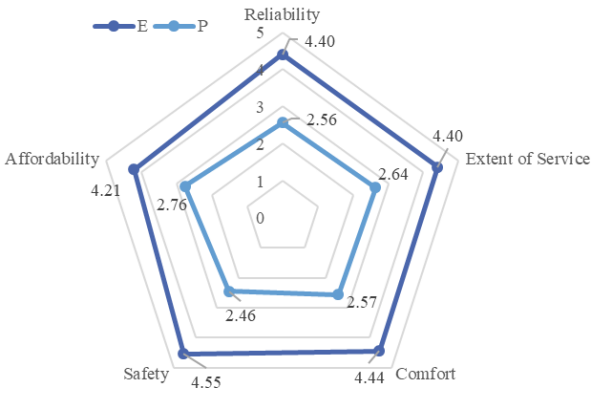

Figure 5: Average gaps in the five quality aspects

The Kruskall-Wallis H test was carried out to compare the mean gap scores of the five service dimensions: reliability, extent of service, comfort, safety and affordability. The Mann-Whitney U test was performed to identify the specific dimension pairs with statistically significant different gaps. As shown in table 3, the Kruskall-Wallis H test showed that there is a significant difference in gap score for at least one of the pair of the services at significance level 0.05. Mann-Whitney U test identified the specific service pairs with significant difference in gap score. As the table shows there is significance difference in gap score for all dimension pairs expect reliability-extent of service, reliability-comfort and extent of service-comfort pairs. Pair formed with safety and affordability seem to have significance difference in gap.

Figure 5 shows the average passengers' expectations and perceptions for each of the five quality aspects reliability, comfort, extent of service, safety and affordability calculated using the corresponding average values for each of the attributes. As the figure clearly shows passengers' have highest expectations (4.55) on safety and the perception the safety provision of the existing services is only 2.46 showing a highest gap of 2.09 among all the quality aspects. The next high gap score of 1.87 was observed for comfort aspect. The least gap of 1.45 is observed for affordability.This is followed by comfort aspect with gap score 2.02. The least gap of 1.74 is observed for affordability.

To identify a list of attributes that requires immediate

Table 4: Top ten attributes based on average gap score

Rank	Attributes	Gap
1	Safety of women	-2.17
2	Adequacy of capacity of vehicle during peak hours of weekdays	-2.15
3	Drivers use of safety measures	-2.11
4	Safety of belongings inside the vehicle	-2.10
5	Cleanliness and conditions of facilities in the vehicles	-2.01
6	Adequacy of space for seating/standing while traveling	-2.00
7	Timely reaching of the vehicle to the destination	-2.00
8	Drivers awareness to safe driving	-1.97
9	Proper access for old and disable people	-1.97
10	Timely arrival of the vehicle/zero waiting time	-1.94

consideration, the attributes are ranked based on the average gap values. Table 4 provides a prioritized list of ten attributes requiring immediate consideration. Women safety with a maximum gap of 2.17 is the top ranked attribute that requires immediate consideration. The list also includes driver use of safety measures (2.11), safety of belongings inside vehicle (2.10), driver awareness to safe driving (1.97) attributes in safety aspect, timely reaching of the vehicle to the destination (1.94), timely arrival of the vehicle/zero waiting time (1.94) attributes in reliability aspect, adequacy of space for seating/ standing while traveling (2.00), cleanliness and conditions of facilities in the vehicles (2.01) attributes in comfort aspect, adequacy of capacity of vehicle during peak hours of weekdays(2.15), proper access for old and disable people (1.97) attributes in extent of service aspect and no attributes in affordability aspect as among the top ten prioritized areas requiring immediate intervention.

5. Conclusion and Recommendation

This study conducted an analysis of quality of public transportation services in Kathmandu Valley based on passengers' expectation and perception. SERVQUAL approach based on RECSA elements is used for the analysis. The analysis of passengers' responses shows:

- Passengers' expectations and perceptions towards public transportation services are significantly different for all twenty-two attributes considered in the study. Moreover, the gap scores in all cases are negative indicating need of interventions in all five aspects of reliability, extent of service, comfort, safety and affordability.
- The mean gaps of safety and affordability dimensions are observed to be significantly different from those observed for reliability, extent of service and comfort aspect. Safety and affordability with average gap scores of 2.09 and 1.74 respectively are the quality aspects with the highest and least gaps.
- Gap analysis shows safety of women with a gap score of 2.17 is the attribute with maximum gap.

The study also provides a prioritized list of the areas that can be immediately considered for improvements to enhance the public transportation services in Kathmandu Valley. This can facilitate planners, policy makers and decision makers to look to identify the areas requiring immediate improvements. Further research can be carried out to compare the different types of services to identify the corresponding specific areas of improvements. One of the limitations of the study is that weight-age value of one attribute over other was not considered that could better reflect the prioritized area. Also, it is purely qualitative and does not provide quantitative benchmarks of improvements. Therefore, further research can be also carried out to establish quantitative benchmarks for each of the critical attributes.

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