# FACTOR ANALYSIS OF SERVICE QUALITY ATTRIBUTES RELATED TO PASSENGER SATISFACTION FOR KAMALAPUR RAILWAY STATION

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#### **ABSTRACT**

Kamalapur railway station is Bangladesh's largest and the busiest railway station. So, determining how this station is serving according to passengers' perception is important. The objective of this research is to identify the significant factors among the service quality attributes of Kamalapur railway station by factor analysis using passengers' perception and how to improve the present condition of the identified factors for ensuring passenger satisfaction. An online survey was conducted for the Kamalapur railway station using google form in April 2021. Data were collected from various ages, occupations, and income groups to get a representative sample. In the first run of factor analysis, 15 attributes were used as 15 independent factors. Two factors were extracted from the first run. Which are "availability of porters" and "food facilities". To ensure whether more factors are available or not there's a need to run further analysis. Two new factors are extracted from the second, third, and fourth analysis which are "cleanliness," and "seating facilities". The result showed that there was a total of 4 factors among the 15 attributes and these 4 factors are in belowaverage condition based on the analysis. Seating facilities appeared to be comparatively better from the passengers' perception as it was ranked first (2.74 out of 5) among the identified factors although it's in below-average condition. Cleanliness (2.55), availability of porters (2.54), and medical facilities (2.38) are in the second, third, and fourth positions respectively and they're also in below-average condition. From the above findings, some recommendations are provided on how the condition of the identified factors can be improved for ensuring passenger satisfaction.

**Keywords:** Kamalapur railway station, Service quality, Factor analysis.

## 1. INTRODUCTION

Transportation evolution has come to pass for developing financial chances. Feasible growth can't be skilled without appropriate transport facilities. Bangladesh is a developing country. Dhaka, as capital is burdened with a rapid growth which triggers transport related challenges like congestion, accidents, public transport decline, and environmental pollution. Inadequate public vehicle has crucially expanded people's sufferings. It has affected the nearby cities as well which is caused by gruesome congestion. Among 166.3 million populaces of Bangladesh, the capital has a populace of about 21.74 million (Bangladesh population meter (2021)-Worldometer). Dhaka is going through a spontaneous urbanization such as the ongoing constructions of mega projects. The increase of population with this spontaneous urbanization has influenced the transportation orchestration of Dhaka. Transport as an important part of the nation's economy starts with water transport since the land is basically riverine in the Bengal areas mainly. Later different modes of travel like roadways, waterways, railways are developed. People preferred waterways as the easiest for movements and carrying goods then but clumsy and unprincipled construction activities have invalidated the chances of waterways development in Bangladesh (Sohel Mahmud & Shamsul Haque, 2014). A huge city like Dhaka is at a phase where the centralization of movement request cannot effectively be taken care of by the road-based system. So, the development of an urban rail system has become essential. Railroad area has been the priority of the current Government by understanding how much significant the railroad correspondence is.

Bangladesh is a small country with limited road capacity, necessitating the use of a highly efficient vehicle with a huge capacity [1][2]. As a result, the railway can be assumed to be an efficient mode of transportation which can be capable of carrying more passengers and freight. But rail transport experienced a rapid decline at the second half of the 20th century because of the developments in road and air transport. It is critical for transportation planners to support a long-term solution by ensuring high-quality public transportation services to ensure mobility. In this case, it is possible to improve the current situation by encouraging the use of rail. It provides a large geographic coverage of access services, reduces journey time, and provides excellent passenger services. In Bangladesh, the railway is a popular mode of transportation since it is inexpensive, comfortable, and safe. It has a huge impact on Bangladesh's national economy by contributing significantly to the resolution of communication needs and employment issues. As the railway transports a high number of people, the key problem is to ensure that all passengers receive the same level of service.

Quality evaluation of public transit services is still a main issue in transportation engineering as transit is often argued as a promising travel mode to reduce automobile dependence. Transit service providers should measure the performances of their service to verify the productivity and quality of the service. These measures can easily be used for monitoring the service, estimating economic performance, supervising the organization, setting service design standards and heeding community benefits. Furthermore, developing an understanding of passenger service needs is important to gain more ridership and a modal shift in favor of rail. Service quality satisfaction is usually evaluated in terms of technical quality and functional quality. But users are less concerned about the technical aspects of a service. So, functional quality becomes the major criteria to evaluate service quality. Service quality can be increased by inspecting passengers' experiences on trains and at stations and creating passenger satisfaction surveys regarding their perceptions and expectations.

The major goal of this study is to determine factors related to service quality in Kamalapur railway station. The study's objectives are to determine the significant factors using passengers' perception by factor analysis, understand the significance of the identified factors and the reason behind other attributes not being factors. Some general recommendations have been provided based on the identified factors and what can be done with other attributes which could not be identified as factors [3]. This study is conducted for Kamalapur railway station by an online questionnaire survey for factor analysis using passengers' perception. The aim of this study is to examine the significant factors of railway station service quality

based on overall passenger satisfaction. Results offer a perspective of the attributes which have been determined as significant factors and their ranking based on the mean values. Mainly, to suggest some recommendations to improve the service quality of Kamalapur railway station.

#### 2. LITERATURE REVIEW

Numerous scholars have emphasized and prioritized the importance of "passenger perception" in the context of assessing the quality of railway services.

Fu and Xin (2007) explored the relationship between train passenger happiness and service qualities. To assess associations between attributes, they used factor analysis and regression analysis. They proposed a transit service indicator (TSI) that evaluates the level of service by considering the impact of supply on demand. The TSI utilizes different quality metrics at the same time, such as frequency and coverage.

Cavana et al. (2007) proposed the SERVQUAL technique, which incorporates comfort, connectivity, and convenience to evaluate passenger rail service quality using regression analysis. Reliability, responsiveness, and empathy were found to have significant effects on total service quality.

Nathanail (2008) established a methodology for evaluating the service quality of railways based on a passenger questionnaire survey and divided qualities into six categories. Schedule accuracy, system safety, cleanliness, passenger comfort, service, and passenger information were considered to be the most significant features.

Geetika (2010) investigated the elements that influence consumer satisfaction with service quality on railway platforms [4]. The information of train schedule, personal safety, cleanliness, clarity of information, behavior of railway staffs and basic facilities supplied on platforms were all determined using factor analysis. Passengers ranked refreshments and behavioral aspects as the most important.

But these attributes were not assessed using exploratory and confirmatory factor analysis based on passengers' perception before. In this study we will identify the significant factors related to service quality of a station by factor analysis using passengers' perception collected from a questionnaire survey and the factors will be ranked according to their mean values

## 3. METHODOLOGY

The main objective of this study was to identify the significant factors from 15 attributes that are closely related to the service quality of Kamalapur railway station by factor analysis using passengers' perception in IBM SPSS software. A questionnaire survey was initially conducted and responses were taken online due to the pandemic situation. The questionnaire was designed with 15 attributes for factor analysis.

## 3.1 Data Collection Area

The principal railway station of Bangladesh is Kamalapur railway station which is located in Motijheel, Dhaka, to the north—east. It is Bangladesh's largest railway station and the busiest transportation hub between Dhaka and the rest of the country. There are 47 local trains, 40 mail/express trains, and 30 intercity trains that stop at the station. Dhaka Railway Station has eight platforms. It is one of the hubs of intercity trains of Bangladesh. Therefore, it is selected as a survey location to cover the maximum number of passengers. After selection of survey location, a questionnaire survey has been prepared to complete the survey properly.

## 3.2 Survey Data Collection Procedure

Kamalapur Railway Station was selected as the survey location for two reasons: first, it is Bangladesh's largest railway station, and second, it is the busiest transportation hub between Dhaka and the rest of the country. 15 multiple choice questions were prepared using a Google form for the questionnaire survey. The purpose of the questionnaire was to gather information about passenger trips in terms of gender, age, travel frequency, and income level, as well as to conduct factor analysis using passengers' perception about different attributes related to service quality. The purpose of factor analysis was to identify the significant factors that are closely related to the service quality of the station. Passengers' perception towards 15 attributes were collected in the survey from their travel experiences.

The attributes were selected after reviewing the literature, focused group discussion (FGD) and past studies on factor analysis and service quality based on passenger satisfaction of different countries. The attributes can vary from country to country. So, we chose the suitable attributes that are relevant to the station's service quality of our country. Table 1 represents the description of the selected attributes.

# 3.3 Characteristics of the Respondents

The survey data has been analyzed by score method to evaluate the passengers' level of satisfaction. The respondents marked the different service attributes as 1 for very poor, 2 for poor, 3 for fair, 4 for good, and 5 for excellent. Table 2 represent the characteristics of the respondents in both absolute and relative terms. And table 3 represent the detailed distribution of responses of selected attributes.

Table 2: Characteristics of	the respondents.
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Characteristics	Passenger profile	Percentage	Total
Gender	Male	65.3	100%
	Female	34.7	100%
Age	Less than 15 years	1.0	
	16-25 years	45.4	
	26-35 years	14	100%
	36-45 years	17.5	100%
	46-55 years	14.8	
	More than 55 years	7.3	
Profession	Housewife	15.6	
	Business	18.8	
	Student	40.3	100%
	Employee	23.9	
	Others	1.4	
Monthly	Less than 10,000/=	47.6	
income	10,000-20,000/=	15.3	100%
	20,000-45,000/=	100%	
	More than 45,000/=	18.5	
Dumosa of Trin	Travel	33.9	
Purpose of Trip	Travel to home town	30.1	100%
	Office work	10070	
	Others	12.9	

Table 3: Detailed distribution of responses

A 44	C	Percentages (%)						M
Attribute code	Service quality attributes	Very Good	Good	Average	Poor	Very Poor	- Total (%)	Mean value
1	Courtesy of stuffs	1.4	16.1	41.9	27.2	13.4	100	2.65
2	Personal safety	1.6	11.0	37.9	31.5	18.0	100	2.47
3	Frequency of maintenance	2.7	16.1	37.1	28.2	15.9	100	2.62
4	Availability of porters	2.4	11.3	39.8	30.9	15.6	100	2.52
5	Information of train schedule	3.2	21.0	40.9	22.8	12.4	100	2.80
6	Clarity of information	2.4	19.9	41.4	28.2	8.1	100	2.80
7	Cleanliness	0.6	14.0	41.9	27.4	16.1	100	2.55
8	Food facilities	0.6	13.7	38.7	34.4	12.6	100	2.55
9	Medical facilities	0.8	8.6	39.8	29.8	21.0	100	2.38
10	Parking facilities	7.3	26.1	36.3	23.4	7.0	100	3.04
11	Seating facilities	1.6	19.1	38.2	33.3	7.8	100	2.74
12	Comfortable in buying tickets	1.9	12.1	40.3	33.6	12.1	100	2.58
13	Easy access of travel information	1.6	17.5	51.1	23.9	5.9	100	2.85
14	Overall appearance	0.9	13.7	57.5	23.1	4.8	100	2.83
15	Frequency of trains	2.1	19.6	57.8	16.7	3.8	100	3.00

## 4. DATA ANALYSIS

After collecting the data, factor analysis was conducted in SPSS. To determine factors from analysis some runs has been conducted. After 1st run, to know if more factors are available or not the factor analysis has to be conducted again excluding attributes that have been already determined as factors in previous run. These runs have to be conducted furthermore until all the factors been extracted.

## 4.1 1st run

In the beginning, Kaiser-Meyer-Ohlin Measure and Bartlett's test was conducted to determine the significance and sampling adequacy. Table 4 summarizes the KMO and Bartlett's test from SPSS analysis. The KMO measure of sampling adequacy has been found out to be 0.861. This value varies between 0 and 1 in which 0 indicates that the factor analysis is likely to be inappropriate and 1 indicates that the factor analysis should be yield distinct. It is recommended that values starting from 0.5 can be accepted. So, it can be said that the value which has been found out is acceptable because it satisfies the range. An approximate chi-square value is found at 1723.509 which is a significant value.

Table 4: KMO and Bartlett's Test from SPSS analysis.

1 <sup>st</sup> run	Kaiser-Meyer-Ohlin Measure of Sampling Adequacy	0.861
	Bartlett's Test of Sphericity (Approx. Chi Square)	1723.509
2 <sup>nd</sup> run	Kaiser-Meyer-Ohlin Measure of Sampling Adequacy	0.842
Z" run	Bartlett's Test of Sphericity (Approx. Chi Square)	1488.537
3 <sup>rd</sup> run	Kaiser-Meyer-Ohlin Measure of Sampling Adequacy.	0.833
3° run	Bartlett's Test of Sphericity (Approx. Chi Square)	1376.461
4 <sup>th</sup> run	Kaiser-Meyer-Ohlin Measure of Sampling Adequacy.	0.819
	Bartlett's Test of Sphericity (Approx. Chi Square)	1249.031

Using the Eigenvalues, factors could be determined. Table 5 represents the explanation of total variance. Attributes having Eigenvalues 1 or more than 1 can be called factors. From this table it can be seen that the first three eigenvalues are more than 1 in all the runs.

Run	Factor	Initial Eigenvalues					
analysis		Total	% of	Cumulative			
			Variance	%			
1st run	1	5.012	33.414	33.414			
	2	1.819	12.128	45.542			
	3	1.112	7.411	52.953			
2 <sup>nd</sup> run	1	4.549	34.991	34.991			
	2	1.698	13.065	48.056			
	3	1.073	8.252	56.307			
3 <sup>rd</sup> run	1	4.308	35.897	35.897			
	2	1.692	14.100	49.997			
	3	1.061	8.839	58.836			
4 <sup>th</sup> run	1	4.015	36.496	36.496			
	2	1.651	15.010	51.506			
	3	1.058	9.622	61.128			

Table 6 shows communalities that indicate which attributes exactly are factors. If any initial Eigenvalue is less than 0.3, then it can be called a factor. From this table we can see that in 1st run only two attributes have the value under 0.3 named "availability of porters" and "food facilities". So, these two can be called factors from the table. Now, to determine if more factors are available or not factor analysis needs to be conducted again excluding the two attributes which have been determined as factors.

Table 6: Communality table

A 44	1 <sup>st</sup> run		2 <sup>nd</sup> run		3 <sup>rd</sup> run		4 <sup>th</sup> run	
Attributes	Initial	Extraction	Initial	Extraction	Initial	Extraction	Initial	Extraction
Availability of	0.278	0.301	*	•	•	•	•	
porters								
Food facilities	0.280	0.273						
Cleanliness	0.303	0.270	0.266	0.255				
Seating	0.306	0.311	0.300	0.325	0.295	0.326		
facilities								

Courtesy of staffs	0.445	0.664	0.430	0.886	0.417	0.741	0.417	0.758
Personal safety	0.386	0.460	0.366	0.350	0.358	0.395	0.353	0.387
Frequency of maintenance	0.370	0.473	0.361	0.446	0.360	0.449	0.360	0.452
Information of train schedule	0.463	0.528	0.457	0.526	0.455	0.526	0.448	0.521
Clarity of information	0.471	0.592	0.471	0.624	0.469	0.636	0.468	0.637
Medical facilities	0.371	0.406	0.341	0.354	0.326	0.337	0.326	0.353
Parking facilities	0.378	0.398	0.371	0.407	0.366	0.448	0.316	0.403
Comfortable in buying tickets	0.347	0.351	0.346	0.364	0.340	0.361	0.334	0.361
Easy access of travel information	0.354	0.382	0.342	0.382	0.342	0.383	0.335	0.385
Overall appearance	0.463	0.486	0.462	0.511	0.461	0.516	0.460	0.541
Frequency of trains	0.452	0.466	0.450	0.481	0.425	0.465	0.422	0.467

## 4.2 2nd run

As all the factors could not be extracted, so 2nd run is needed. Only 13 attributes have been taken to run 2nd analysis out of 15 because 2 attributes have already been determined as factors. The Kaiser-Meyer-Ohlin measure of sampling adequacy has been found out to be 0.842. This value varies between 0 and 1 in which 0 indicates that the factor analysis is likely to be inappropriate and 1 indicates that the factor analysis should be yield distinct. It is recommended that values starting from 0.5 can be accepted. So, it can be said that the value which has been found out is acceptable because it satisfies the range. The degree of freedom is determined 78. An approximate chi-square value is found 1488.537 which is a significant value. It has a significance of 0.000 which is less than 0.05. It indicates that this database is suitable for factor analysis.

Table 6 shows commonalities that indicate which attributes exactly are factors. If any initial Eigenvalue is less than 0.3, then it can be called a factor. From this table, we can see that in 2nd run only one attribute has a value under 0.3 named "cleanliness". So, this one can be called a factor from the table. Now, to determine if more factors are available or not factor analysis needs to be conducted again excluding that one attribute which has been determined as factor in 2nd run.

# 4.3 3rd run:

As all the factors could not be extracted, so 3rd run is needed. Only 12 attributes have been taken to run 3rd analysis out of 15 because 3 attributes have already been determined as factors in the previous runs. The Kaiser-Meyer-Ohlin measure of sampling adequacy has been found out to be 0.833. This value varies between 0 and 1 in which 0 indicates that the factor analysis is likely to be inappropriate and 1 indicates that the factor analysis should be yield distinct. It is recommended that values starting from 0.5 can be accepted. So, it can be said that the value which has been found out is acceptable because it satisfies the range. The degree of freedom is determined 66. An approximate chi-square value is found 1376.461 which

is a significant value. It has a significance of 0.000 which is less than 0.05. It indicates that this database is suitable for factor analysis.

Table 6 shows communalities that indicate which attributes exactly are factors. If any initial Eigenvalue is less than 0.3, then it can be called a factor. From this table, we can see that in 3rd run only one attribute has a value under 0.3 named "seating facilities". So, this one can be called as a factor from the table. Now, to determine if more factors are available or not factor analysis needs to be conducted again excluding that one attribute which has been determined as factor in 3rd run.

## 4.4 4th run

As all the factors could not be extracted, so 4th run is needed. Only 11 attributes have been taken to run 4th analysis out of 15 because 4 attributes have already been determined as factors in the previous runs. The Kaiser-Meyer-Ohlin measure of sampling adequacy has been found out to be 0.819. This value varies between 0 and 1 in which 0 indicates that the factor analysis is likely to be inappropriate and 1 indicates that the factor analysis should be yield distinct. It is recommended that values starting from 0.5 can be accepted. So, it can be said that the value which has been found out is acceptable because it satisfies the range. The degree of freedom is determined 55. An approximate chi-square value is found at 1249.031 which is a significant value. It has a significance of 0.000 which is less than 0.05. It indicates that this database is suitable for factor analysis.

Table 6 shows communalities that indicate which attributes exactly are factors. If any initial Eigenvalue is less than 0.3, then it can be called a factor. From this table, we can see that in 4th run there is no value under 0.3, so no factor could be found from the 4th run [5][6]. There are no factors that remain on the data set. All factors have been extracted in previous runs. So, there is no need to run further analysis.

## 5. RESULTS AND CONCLUSION

## **5.1 Finding of the study**

For factor analysis, all of the collected data were entered into the SPSS software to extract factors that are closely related to the station's service quality. 4 analyses had to run. The answers to the analysis are given below-

In the first run, 15 attributes were used as 15 independent factors. But only two factors were extracted from the first run which was "availability of porters" and "food facilities". To ensure if more factors are available or not second analysis needs to be run. In the second run, the analysis was done after removing two attributes that were extracted from the first run which are "availability of porters" and "food facilities". Except for these two attributes, there were a total of 13 independent attributes as 13 independent factors for the second run. Only one factor was extracted in the second run which was "cleanliness". To ensure if more factor is available or not, third analysis needs to be run. In the third run, the analysis was done after removing three attributes that were extracted from the first and second runs which were "availability of porters," "food facilities," and "cleanliness". Except for these three attributes, there were a total of 12 independent attributes for the third run. Only one attribute was extracted in the third run which is "seating facilities". To ensure if more factors are available or not, a fourth analysis needs to be run. In the fourth run, the analysis was done again after eliminating four attributes found in the first, second, and third runs which are "availability of porters," "food facilities," "cleanliness," and "seating facilities". After removing four attributes from the previous runs, there were a total of 11 independent attributes. But more factors could not be extracted in the fourth run. So, there is no need to run another analysis. In case if another factor could be found in the 4th run, then another analysis might have been needed to run for ensuring if more factors could be extracted or not.

The mean values of seating facilities, cleanliness, availability of porters, and medical facilities are 2.74, 2.55, 2.54, and 2.38 respectively. The mean values of identified factors are in between 2 to 3 which means the attributes are in below-average condition. As these attributes are closely related to the station's service quality, so it can be said that the service quality of Kamalapur railway station is below average. 4 attributes have been found as factors because passengers are more concerned about these 4 attributes. These attributes help them to make accurate decisions about rating the station's service quality. Most of the passengers' perception about these 4 attributes are nearly the same. That's why these could be extracted easily by factor analysis. As they are in below-average condition, they need to be improved. The other 11 attributes could not be extracted from the factor analysis because passengers might not give proper answers for these attributes or it can be said that passengers could not take these 11 attributes seriously that can affect the service quality of the station.

#### 5.2 Recommendations

Medical facilities need to be improved more than the other attributes because medical facilities were ranked below. The mean value of cleanliness and availability of porters is near 2.5 which means their condition is in-between average to poor. So, these need to be improved as well. Lastly, the seating facilities of the station is 2.74 which indicates the seating condition is below average. Authority needs to take proper steps to improve these. It is advised that the railway ministry take all the reasonable steps to publicize the various services provided to passengers by posting suitable index boards and bulletin boards in prominent locations such as the entrance, ticket reservation desk, waiting for the area, and platforms. By printing services and facilities on tickets and displaying them on platforms, the Ministry of Railways can raise awareness of the services available to passengers. To ensure a welcoming environment for passengers, the railway authority should take required steps against unlawful activities such as pickpocketing, harassment, robbery, etc. in the station areas. Excessive pressure on railway service has evolved as a result of rising transportation demand. However, there has been no parallel development in train services to match the rising demand. As a result, there is a larger need for this service to be improved to entice more passengers to use it. It is possible to conclude that the railway authorities should consider passengers' perceptions.

# 5.3 Limitations of Study

People may not be truthful while providing information. Some respondents might not provide an accurate response which affected this study's results. These attributes have a lack of information parameters. Due to the global pandemic crisis, physical involvement in this research could not be as extensive as it should have been. As a result, this study and its findings are not much accurate as they should be. For better results, data collecting should have been done throughout the day and night to gain more knowledge. Due to COVID-19, we were forced to use a google form to obtain data from an online survey. This form was shared in various travel groups. As a result, data is highly variable. One of the most significant disadvantages of using secondary data is that it may not address the researcher's unique study questions or contain specific information that the researcher desires. This study could not be processed for a longer period due to unavoidable circumstances. A total of 373 responses were randomly collected for this study. Data might be more precise. The more data collected in this study, the more precision could be achieved. As the sample size in this study is inadequate, more research could be conducted with a larger data set which could help more accurately in conducting the factor analysis. If someone uses the same data set as ours but with a different analysis method or different modeling techniques, the results may vary.

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