SERVICE QUALITY OF METRO RAIL AND ITS IMPACT ON COMMUTERS SATISFACTION: A COMPARATIVE STUDY OF SELECTED SOUTH INDIAN CITIES

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Abstract

Services are people centric, humanistic and subjective and the outcome of service mainly depends on its quality. Service quality is the comparison of perceived expectation of a service with perceived performance. This empirical study attempts to understand the dimensions of service quality in the context of Metro Rail Corporations among South Zone of India. Metro is a rapid transit system serving the demographic and geographic needs of people. To ensure reliability and safety in train operations, it is equipped with most modern communication technology and train control system. It offers number of benefits to commuters such as long-distance travel, safe travel, high speed and hassle-free travel. The present study is conducted using SERVQUAL model to find and analyze commuter's perception on ten service quality dimensions – Reliability, Responsiveness, Understandability, Communication, Credibility, Courtesy, Tangibility, Empathy, Assurance and Security and to identify level of commuter's satisfaction on services provided by MRCs. The study is carried out by using structured questionnaire. Convenience sampling with 814 respondents were taken for data collection.
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Keywords: Commuter's perception, Service Quality, MRCs, SERVQUAL

1. Introduction

As the demography of any community or region evolves and grows, there will be an inherent demand and scope for various allied services and opportunities for employment and subjective development.

Quoting with the days immemorial services like transportation, logistics and the industries linked with diverse kinds of supply chain finds its importance in the pivotal center of human development and economic growth.

In the modern era of urbanization and rapid population growth, efficient and reliable public transportation systems play a pivotal role in easing the mobility challenges faced by millions of commuters.

Research gap: The literature study provides substantial evidence to support that the major number of studies are reported related to Delhi metro, Mumbai and Kolkata metro railway services and its deliverables of service quality. No major studies are reported yet with regard to the measurement of service quality of south zone metro railway services i.e. Bangalore Metro (Karnataka), Chennai Metro (Tamil Nadu), Kochi Metro (Kerala) and Hyderabad (Telangana) metro respectively. The present study is designed to study the comparative aspects of service quality dimensions among commuters of Bangalore and Hyderabad Metro so that the consumer satisfaction is better addressed and probable inferences may be drawn. An attempt is made so that the Managerial Implications of consumer behavior are recognized and rewarded in the interest of commuter's satisfaction ensuring sustainability of profitability and financial appraisal of the Metro projects.

Need for the study: The details of metro infrastructure and its expansion of services highlight the importance of the study to be undertaken. It is worthy to mention that any project of industrial development needs to be critically evaluated for its managerial feasibility including financial and technical appraisals. The financial appraisal aspects largely depend on the technical and managerial aspects of Return on Investments (ROI) and its profitability Index (PI). The success or failure of such infrastructure projects largely depends on social approval and the utility of services as experienced and perceived by the customers. The present study is proposed in the interest of analyzing dimensions of service quality in conjunction with consumer satisfaction of the commuters of Metro rail services of south zone.

City	Opening Date	Length (Km)	No. of Stations	Km/ Station	Lines	Km/ Line	Station/ Line
Seoul Metropolitan Subway	15.08.1974	316.3	328	1.0	9.0	35.1	36.4
Barcelona Metro	30.12.1924	125	166	0.8	11.0	11.4	15
Beijing Subway	01.10.1969	372	190	2.0	15	24.8	13
Tokyo Metro	30.12.1927	203.4	168	1.2	9	22.6	19
Moscow Metro	15.05.1935	305.7	185	1.7	12	25.5	15
Shanghai Metro	10.04.1995	434	277	1.6	11	39.5	25
London Underground	10.01.1863	402	270	1.5	11	36.5	25
New York Subway	27.10.1904	337	421	0.8	34	9.9	12
Montreal Metro	14.10.1966	69.2	68	1.0	4	17.3	17
Santiago Metro	15.09.1975	103	108	1.0	5	20.6	22
Cairo Metro	1987	65.5	53	1.2	2	32.8	27
Paris Metro	19.07.1900	214	300	0.7	16	13.4	19
Vienna U-Bahn	08.05.1974	74.5	101	0.7	5	14.9	20

Table 1: Salient Features of Different Metro Rail System around the World

Source: Journal of Infrastructure Development, 5, 1 (2013): 67–86

The findings of the study may be helpful for the policy makers and managerial staff so that metro services are executed more consumer friendly and Service Quality concerns are better addressed.

2. Research Questions

➥ How do demographic variables affect commuters' perceptions?

➥ What would be significant differences in the service quality of metro rail across different cities?

➥ What would be the impact of service quality of metro rail on Customer Satisfaction

3. Statement of the problem

The metro rail systems play a crucial role in urban transportation, offering a sustainable and efficient mode of travel for millions of commuters worldwide. However, ensuring high levels of service quality remains a persistent challenge for metro authorities, as they strive to meet the diverse needs and expectations of commuters while addressing operational constraints and budgetary limitations. Despite significant investments in infrastructure and technology, metro rail systems continue to face issues related to reliability, responsiveness, safety, accessibility, and customer satisfaction. Moreover, demographic variations among commuters, such as age, income, occupation, and travel frequency, further complicate efforts to deliver consistent and equitable service quality across different user groups and regions. Therefore, there is a pressing need for research to identify the key dimensions of service quality within metro rail systems, analyse their relationship with demographic factors, assess their impact on commuter satisfaction, and develop strategies to enhance overall service quality and customer experience. This study aims to address these gaps by investigating the service quality perceptions of commuters in metro rail systems, examining the demographic factors influencing these perceptions, and providing insights and recommendations for improving service quality and customer satisfaction in the future.

4. Objectives of the study

1. To analyse significant differences in the service quality of metro rail across different cities

2. To study the impact of service quality of metro rail on Customer Satisfaction

5. Hypotheses for the study

Hypothesis is the statement which is yet to be proven. In the present study, non-directional hypothesis is used. The hypotheses were tested at five percent level of significance. Hypothesis is used in almost all the researches as it validates the assumption of researcher. Different hypotheses are framed during the course of study. These hypotheses are tested by regression and Chi square test.

Hypothesis 1

H (0): There are no significant differences in the service quality of metro rail across different cities

H (1): There are significant differences in the service quality of metro rail across different cities

Hypothesis 2

H (0): There is no the impact of service quality of metro rail on Customer Satisfaction

H (1): There is an impact of service quality of metro rail on Customer Satisfaction

6. Research methodology

Overview of Methodology Research methodology is a tool which provides us a smooth and clear path to achieve the predefined objectives, hypothesis/theory/model. It discusses method/process of research, nature and structure of data, method of data collection, data identification, data classification, data analysis, and tools required for analysis of data & result. Thus, we can say that research methodology is a blue print of collecting, measuring and analyzing the data related to the objectives.

In the beginning of the research, objectives of the study are determined. The hypotheses of the study are determined based on objectives of the study. For collecting the data total 814 samples are used. Data are collected through questionnaire on the basis convenience sampling due to easy accessibility and affordability.

Structured questionnaire is used for opinion survey and five point Likert Scale is used for data collection. Respondents were asked to indicate their degree of agreement or disagreements on 1 to 5 point Likert Scale right from strongly agree to strongly disagree. Initially 50 questionnaires were used for the pilot study to check validity of questionnaire. Content validity test is used to test the validity of questionnaire. The questionnaire was revised several times to make it more understandable to the respondents and relevant for the study. The opinion of research experts were also incorporated in the questionnaire

While conducting the research, 81 variables belonging to different services of South Zone Metro were identified to carry out research. These variables were identified through depth interview, focus group interview, and extensive review of literature.

The sample was selected from different metro stations of Bangalore, Chennai and Hyderabad Metro. Various hypotheses were framed during the course of study and it is tested by using appropriate statistical test. For the data analysis purpose, statistical measures such as correlation, regression analysis, chi square test, factor analysis and Multivariate analysis is administered. Chi square test is performed in order to analyze relationship between of demographic variables and independent variables causing passenger satisfaction.

Method of Data Collection

The data collection method depends on the type of research. As the study is empirical in nature, so survey method was used and non-disguised structured questionnaire was designed for the study. The objectives of the study were explained to the respondents and they were asked to fill out the questionnaire in a self-administered manner. Both primary data and secondary data are collected for the study. The secondary data help to validate the variables used in the questionnaire, methodology used in the analysis related to the objectives and so on.

Data Source: Primary and Secondary

The data of the current study is based on both primary and secondary sources.

➡ Primary Data

Data has been collected primarily from self-structured, closed-ended Questionnaire, Using a Likert, 5-point scale, questions were administered to commuters of Bangalore, Chennai, and Hyderabad. The questionnaire consists of five parts

Part I includes questions on the Demographic aspects of commuters.

Part II includes questions on the Service Quality Aspect of Metro

➡ Secondary Data

Research articles, Books, Journals, Reports

7. **Limitations of the study**

The study was based on the south zone of the Metro Rail services in India. However the study covers only Bangalore, Chennai and Hyderabad.

It does not include Kochi Metro.

The proposed South Zone Metro rail services significantly differ with regard to the geographical terrain, heritage and cultural aspects of the demographic variables. The comparative inferences drawn may not be justified.

The time frame of the study may be an add-on limitation as it is going to be time tested, happens to be dynamic, the technological advancements and managerial innovations are ever-evolving.

8. **Review of literature**

The current chapter summarizes study findings and research areas not covered in previous studies. The primary goal of this chapter is to conduct a systematic review of the most relevant previous research works relative to the current study's title. This chapter gave summaries of previous research, based on which the research gap to be filled by contemporary study was identified. The summaries of earlier research were presented in four sections i.e., Safety, Security, Service and Satisfaction based on these dimensions to determine the research gap to be filled by recent research.

Classification of Literature

All relevant literature on the current topic is segregated into four dimensions based on S^2 factors: Service and Satisfaction.

Service

1. Anjali Awasthi, (2011) Undertaken a study based on SERVQUAL a hybrid technique and fuzzy TOPSIS was evaluated for evaluating the service quality of urban transportation networks. They believe that managing service quality is critical to retaining customer happiness and increasing income for any firm. Service quality is frequently difficult to assess due to a lack of quantifiable measures and insufficient data.

2. Srivastava, (2017) The study was conducted on the Delhi Metro which is a significant addition to the existing public transport system of Delhi and NCR and it appreciably changed the travelling experience of commuters. The present paper proposes ten new services to Metro Railway to improve service quality and effectiveness of existing services from the perspective of commuters. In this study total of 1015 samples were taken from all 160 metro stations and maximum responses were taken from the busiest metro stations. The result of this study reveals that commuters very much agreed to introduce eight new services out of ten proposed services that were explored in this study.

3. Vivek, (2021) study attempts to explore the factors and their effects that influence the service quality of Multimodal Transportation Hub (MMTH) in Anand Vihar, Delhi. A total of 515 samples were collected using a satisfaction survey of public transport users. The results also demonstrate that evaluation of the overall service quality is better explained when people give ratings after knowing about the various attributes of MMTH's service quality. An external validation test is carried out, and results suggest that the values of service quality lie within the mean error range of ±6.5%, which presents the richness of the model. The findings of the study will help the government, operators and transport planners to formulate policies in order to improve the service quality of the multimodal hub and ultimately promote the use of public transport.

Satisfaction

4. Bikramjit et al., (2015) Five dimensions of Service Quality SERVQUAL were taken in this research paper which is Tangibility, Reliability, Responsiveness, Assurance and Empathy. The result indicates that a larger gap has been found in Reliability and Assurance dimensions of Railway service quality and the most important factors determining satisfaction of passengers are basic facilities, safety & security, punctuality and employee behavior towards passengers. It was found that the dimensions that influence the good services were Reliability and Assurance.

5. Parasuraman et al., (2005) Using the means-end framework as a theoretical foundation, this article conceptualizes, constructs, refines, and tests a multiple-item scale (E-S-QUAL) for measuring the service quality delivered by Web sites on which customers shop online. Two stages of empirical data collection revealed that two different scales were necessary for capturing electronic service quality. The basic E-S-QUAL scale developed in the research is a 22-item scale of four dimensions: efficiency, fulfillment, system availability, and privacy. The second scale, E-RecS-QUAL, is salient only to customers who had non-routine encounters with the sites and contains 11 items in three dimensions: responsiveness, compensation, and contact. Both scales demonstrate good psychometric properties based on findings from a variety of reliability and validity tests and build on the research already conducted on the topic. Directions for further research on electronic service quality are offered. Managerial implications stemming from the empirical findings about E-S-QUAL are also discussed.

9. Conceptual framework of service quality

Service quality and customer satisfaction are considered significant issues in most service industries. The high and unique quality is a way to win customers and make them loyal for a long time. Management literature proposes many concepts and approaches concerning how to deal with service quality. There are also many different concepts of how the notion of "service quality" should be understood. Delivering appropriate service quality plays an increasingly important role in service industries such as insurance, banking etc as the service quality is critical to the profitability and survival of these organizations. Therefore, it is worth measuring service quality to obtain a better understanding of the service quality delivered by organizations.

1. **Service**: A type of economic activity that is intangible is not stored and does not result in ownership. A service is consumed at the point of sale. Services are one of the two key components of economics, the other being goods.
2. **Quality:** Quality is the ongoing process of building and sustaining relationships by assessing, anticipating and fulfilling stated and implied needs.

Meaning of Service quality: Service quality has been defined by Robinson as "an attitude or global judgment about the superiority of a service".

To measure service quality using the SERVQUAL model, researchers typically use a survey questionnaire that asks customers to rate their expectations and perceptions of service quality across each of these five dimensions. The resulting data can be analyzed to identify gaps between customer expectations and perceptions, which can help service providers pinpoint areas for improvement and prioritize efforts to enhance overall service quality.
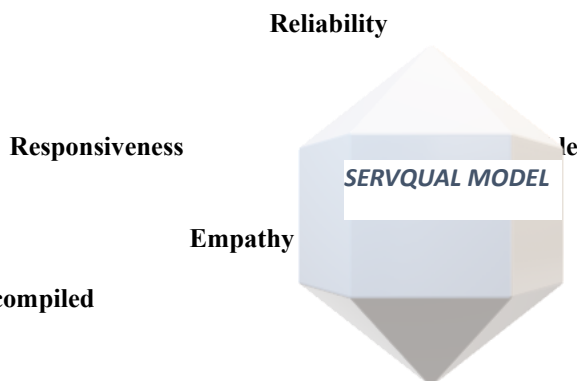

Fig 1: Author compiled

The SERVQUAL scale was developed by Parasuraman et al in 1985 and refined in 1988, 1991 and 1994 which would be used to measure service quality across a broad range of service categories. Within the SERVQUAL model, service quality is defined as the gap between customer perceptions of what happened during the service transaction and his expectations of how the service transaction should have been performed. Formerly 10 dimensions of service quality were proposed (reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding the consumer and tangibles). Later these were reduced to five (reliability, responsiveness, empathy, assurances and tangibles). The later model of five quality dimensions (RATER) considered the following issues:

R: Reliability: Ability to perform the promised service dependably and accurately.

A: Assurance: Ability, knowledge and politeness of employees to inspire trust and confidence.

T: Tangibles: Physical facilities, equipment and appearance of employees.

E: Empathy: Individualized, caring attention that the firm provides to its customers.

R: Responsiveness: Willingness to help customers and provide timely service.

Service Quality in Metro

Service quality has been viewed as a determinant of customer satisfaction. Different dimensions of service quality have been considered by various researchers. Customer satisfaction was the customer's evaluation of services after purchase as opposed to their expectations (Oliver, 1997; Zeithaml and Bitner, 2000). Baker and Crompton (2000) defended satisfaction as a personal experience and mentality related to the nitration between personal expectation and actual receive.

Services are intangible and their assessment by customers may be difficult. Its measure is also the attitude or judgements of customers about the quality of the service. Below are some factors of service quality:

1. **Process quality**: Also referred to as operational quality, this factor determines the quality of procedures involved in production processes.
2. **Output quality:** Also referred to as technical quality, this factor comes after production and determines what customers receive from service providers.
3. **Physical quality:** This focuses on the quality of the product that a customer receives or the quality of support for the products.
4. **Interaction quality:** This factor involves relationships between customers and service providers where interactions happen via different communication channels.
5. **Organisation quality:** The perception or the reputation of an organisation is organisation quality where customers having faith in a brand is important.

Demographic Profile of Commuters of Metro Rail:

With respect to the first objective of this study the present section of this chapter deals with the analysis of the demographic profile of commuters of metro rail.

Table 1: Place of the commuter

	Frequency	Per cent
Bangalore	287	35.25
Hyderabad	256	31.44
Chennai	271	33.29
Total	814	100.0

Source: Primary Data

As per the above table, 35.25% of respondents are from Bangalore 31.44% of respondents are from Hyderabad, and 33.29% of respondents are from Chennai.

Table 2: Gender

	Frequency	Percent
Male	478	58.72
Female	336	41.28
Total	814	100.0

As per the results, 58.7% of the respondents are male and 41.3% of the respondents are female.

Table 3: Age Group

	Frequency	Percent
18 - 30 years	610	74.94
31 - 44 years	170	20.98
45 - 50 years	18	2.21
> 51 years	16	1.97
Total	814	100.0

When it comes to age, 74.9% of the respondents belong to the age group of 18 – 30 years, 20.9% of them belong to 31 – 44 years, 2.2% of them belong to 45 – 50 years and 2% of them belong to the age group of 51 years and above.

Table 4: Occupation

	Frequency	Percent
Student	317	38.94
Full time employed	432	53.07
Part time employed	48	5.90
Retired	17	2.09
Total	814	100.0

According to the occupations of 814 respondents, 38.9% are students, 53.1% are full-time employed, 5.9% are part-time employed, and 2.1% are retired.

Table 5: Monthly Income

	Frequency	Percent
< 10000	83	10.2

10001-20000	39	4.8
20001-30000	73	9.0
30001 – 40000	59	7.2
40000 and above	134	16.5
Wish not to specify	426	52.3
Total	814	100.0

The above table depicts the monthly income of the respondents were, 10.2% of them earn less than 10000, 4.8% of respondents' monthly income is 10001- 20000, 9% of them between 20001-30000, 7.2% of them between 30001-40000 and 52.3% of respondents wish not to specify anything.

Table 6: Purpose of use of Metro Services

	Frequency	Percent
Home-work	198	24.3
Home-school/campus	187	23.0
Shopping	130	16.0
Visit	122	15.0
Others	177	21.7
Total	814	100.0

The purpose of using the metro services results in 24.3% of respondents use for travelling from home-work, 23% of them for home-school/campus, 16% of them for shopping, 15% for visiting purpose and 21.7% of the respondents utilize it for other purposes.

Table 7: Travel frequency

	Frequency	Percent
1 trip/week	253	31.1
2-3 trips/week	253	31.1
4-5 trips/week	199	24.4
>5 trips/week	109	13.4
Total	814	100.0

A per the travel frequency of respondents, 31.1% of them take 1 trip per week, 31.1% of them have 2-3 trips per week, 24.4% of them have 4-5 trips per week and 13.4% of the respondents have more than 5 trips per week.

Table 8: Age of mobility through Metro

	Frequency	Percent
Less than a year	92	11.3
Between 1 to 3 years	172	21.1
Between 3 to 5 years	151	18.6
More than 5 years	399	49.0
Total	814	100.0

When it comes to the age of mobility through Metro, 11.3% of the respondents has less than a year, 21.1% of them ranges between 1 to 3 years, 18.6% of them ranges between 3 to 5 years and 49% of the respondents has more than 5 years.

Service Quality Dimensions of Metro

The study identifies ten service quality dimensions namely Reliability, Responsiveness, Competency, Accessibility, Courtesy, Communication, Credibility, Security, Understandability and Tangibility.
Analysis of Perceived Service Quality among Commuters of South Zone Metro Rail
Hypothesis Testing
H₁: There is a significant difference in the perceived service quality among commuters of South Zone metro rail
One-Way ANOVA

Particular		Sum of Squares	Df	Mean Square	F	Sig.
Reliability	Between Groups	1893.661	2	946.830	16.781	.000

	Within Groups	45758.374	811	56.422		
	Total	47652.034	813			
Responsiveness	Between Groups	1709.249	2	854.624	19.104	.000
	Within Groups	36280.191	811	44.735		
	Total	37989.440	813			
Competency	Between Groups	2159.560	2	1079.780	16.134	.000
	Within Groups	54275.233	811	66.924		
	Total	56434.792	813			
Accessibility	Between Groups	4784.650	2	2392.325	20.702	.000
	Within Groups	93718.831	811	115.560		
	Total	98503.480	813			
Courtesy	Between Groups	602.527	2	301.264	18.488	.000
	Within Groups	13215.576	811	16.295		
	Total	13818.103	813			
Credibility	Between Groups	342.836	2	171.418	16.912	.000
	Within Groups	8220.104	811	10.136		
	Total	8562.940	813			
Communication	Between Groups	883.564	2	441.782	18.989	.000
	Within Groups	18868.092	811	23.265		
	Total	19751.656	813			
Security	Between Groups	848.515	2	424.257	18.716	.000
	Within Groups	18383.972	811	22.668		
	Total	19232.486	813			
Understanding Needs of Customer	Between Groups	942.374	2	471.187	20.172	.000
	Within Groups	18943.544	811	23.358		
	Total	19885.918	813			
Tangibility	Between Groups	2396.038	2	1198.019	16.440	.000
	Within Groups	59101.147	811	72.874		
	Total	61497.186	813			

Reliability: The analysis indicates a significant difference in perceived reliability among commuters of the south zone metro rail ($F_{(2, 811)} = 16.781$, $p < .001$). This suggests that commuters have varying perceptions of the reliability of the metro rail service within the south zone.

Responsiveness: There is a significant difference in perceived responsiveness among commuters ($F_{(2, 811)} = 19.104$, $p < .001$). This implies that commuters' perceptions of how responsive the metro rail service is varied across different groups within the south zone.

Competency: The analysis reveals a significant difference in perceived competency of the metro rail service among commuters ($F_{(2, 811)} = 16.134$, $p < .001$). This suggests that commuters have different perceptions of the competency levels of the service within the south zone.

Accessibility: There is a significant difference in perceived accessibility of the metro rail service among commuters ($F_{(2, 811)} = 20.702$, $p < .001$). This indicates that commuters' perceptions of the service's accessibility vary within the south zone.

Courtesy: The analysis shows a significant difference in perceived courtesy among commuters ($F_{(2, 811)} = 18.488$, $p < .001$). This suggests that commuters have varying perceptions of the courtesy displayed by the metro rail service within the south zone.

Credibility: There is a significant difference in perceived credibility among commuters ($F_{(2, 811)} = 16.912$, $p < .001$). This indicates that commuters' perceptions of the credibility of the metro rail service vary across different groups within the south zone.

Communication: The analysis reveals a significant difference in perceived communication among commuters (F (2, 811) = 18.989, p < .001). This suggests that commuters have different perceptions of the communication effectiveness of the metro rail service within the south zone.

Security: There is a significant difference in perceived security among commuters (F (2, 811) = 18.716, p < .001). This implies that commuters' perceptions of the security provided by the metro rail service vary within the south zone.

Understanding the Needs of Customer: The analysis shows a significant difference in perceived understanding of customer needs among commuters (F (2, 811) = 20.172, p < .001). This indicates that commuters' perceptions of how well the metro rail service understands their needs vary within the south zone.

Tangibility: There is a significant difference in perceived tangibility among commuters (F (2, 811) = 16.440, p < .001). This suggests that commuters have varying perceptions of the physical attributes and appearance of the metro rail service within the south zone.

In summary, the results highlight significant differences in the perceived service quality across various dimensions among commuters of the South Zone metro rail. Commuters' perceptions vary in terms of reliability, responsiveness, competency, accessibility, courtesy, credibility, communication, security, understanding the needs of customers, and tangibility. Further analysis and investigation can help identify specific group differences and guide efforts to improve service quality and enhance customer satisfaction within the South Zone metro rail.

Analysis of service quality of metro rail across different cities.

H0: there are no significant differences in the service quality of metro rail across different cities

Dependent Variable	(I) Place of the commuter (Choose the option nearest to your location)	(J) Place of the commuter (Choose the option nearest to your location)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Total Reliability	Bangalore	Hyderabad	-4.61390*	.79690	.000	-6.4850	-2.7428
		Chennai	-.91399	1.59218	.834	-4.6525	2.8245
	Hyderabad	Bangalore	4.61390*	.79690	.000	2.7428	6.4850
		Chennai	3.69991	1.73387	.084	-.3712	7.7711
	Chennai	Bangalore	.91399	1.59218	.834	-2.8245	4.6525
		Hyderabad	-3.69991	1.73387	.084	-7.7711	.3712
Total Responsive	Bangalore	Hyderabad	-4.29187*	.70958	.000	-5.9580	-2.6258
		Chennai	-2.35666	1.41772	.220	-5.6855	.9722
	Hyderbad	Bangalore	4.29187*	.70958	.000	2.6258	5.9580
		Chennai	1.93521	1.54389	.422	-1.6899	5.5603
	Chennai	Bangalore	2.35666	1.41772	.220	-.9722	5.6855
		Hyderabad	-1.93521	1.54389	.422	-5.5603	1.6899
Total Competency	Bangalore	Hyderabad	-4.91204*	.86790	.000	-6.9499	-2.8742

		Chennai	-1.47555	1.73403	.671	-5.5471	2.5960
	Hyderbad	Bangalore	4.91204*	.86790	.000	2.8742	6.9499
		Chennai	3.43649	1.88835	.164	-.9974	7.8704
	Chennai	Bangalore	1.47555	1.73403	.671	-2.5960	5.5471
		Hyderabad	-3.43649	1.88835	.164	-7.8704	.9974
Total Accessible	Bangalore	Hyderabad	-7.21641*	1.14046	.000	-9.8942	-4.5386
		Chennai	-3.58768	2.27861	.257	-8.9379	1.7625
	Hyderabad	Bangalore	7.21641*	1.14046	.000	4.5386	9.8942
		Chennai	3.62873	2.48138	.310	-2.1976	9.4551
	Chennai	Bangalore	3.58768	2.27861	.257	-1.7625	8.9379
		Hyderabad	-3.62873	2.48138	.310	-9.4551	2.1976
Total Courtesy	Bangalore	Hyderabad	-2.56173*	.42826	.000	-3.5673	-1.5562
		Chennai	-1.26377	.85566	.303	-3.2729	.7453
	Hyderabad	Bangalore	2.56173*	.42826	.000	1.5562	3.5673
		Chennai	1.29795	.93180	.345	-.8899	3.4858
	Chennai	Bangalore	1.26377	.85566	.303	-.7453	3.2729
		Hyderabad	-1.29795	.93180	.345	-3.4858	.8899
Total Credibility	Bangalore	Hyderabad	-1.95842*	.33776	.000	-2.7515	-1.1654
		Chennai	-.55689	.67483	.687	-2.1414	1.0276
	Hyderabad	Bangalore	1.95842*	.33776	.000	1.1654	2.7515
		Chennai	1.40153	.73488	.137	-.3240	3.1271
	Chennai	Bangalore	.55689	.67483	.687	-1.0276	2.1414
		Hyderabad	-1.40153	.73488	.137	-3.1271	.3240
Total Communication	Bangalore	Hyderabad	-3.09539*	.51172	.000	-4.2969	-1.8939
		Chennai	-1.60093	1.02240	.261	-4.0015	.7997
	Hyderabad	Bangalore	3.09539*	.51172	.000	1.8939	4.2969
		Chennai	1.49446	1.11338	.372	-1.1198	4.1087
	Chennai	Bangalore	1.60093	1.02240	.261	-.7997	4.0015
		Hyderabad	-1.49446	1.11338	.372	-4.1087	1.1198
Total Security	Bangalore	Hyderabad	-3.03266*	.50511	.000	-4.2187	-1.8466
		Chennai	-1.57613	1.00920	.263	-3.9457	.7935
	Hyderabad	Bangalore	3.03266*	.50511	.000	1.8466	4.2187
		Chennai	1.45652	1.09901	.381	-	4.0370

						1.1240	
	Chennai	Bangalore	1.57613	1.00920	.263	-.7935	3.9457
		Hyderabad	-1.45652	1.09901	.381	-4.0370	1.1240
Total Understand	Bangalore	Hyderabad	-3.21307*	.51274	.000	-4.4170	-2.0091
		Chennai	-1.47479	1.02444	.321	-3.8802	.9306
	Hyderabad	Bangalore	3.21307*	.51274	.000	2.0091	4.4170
		Chennai	1.73828	1.11561	.265	-.8812	4.3577
	Chennai	Bangalore	1.47479	1.02444	.321	-.9306	3.8802
		Hyderabad	-1.73828	1.11561	.265	-4.3577	.8812
Total Tangibility	Bangalore	Hyderabad	-5.15201*	.90566	.000	-7.2785	-3.0255
		Chennai	-1.96403	1.80948	.523	-6.2127	2.2847
	Hyderabad	Bangalore	5.15201*	.90566	.000	3.0255	7.2785
		Chennai	3.18798	1.97051	.239	-1.4388	7.8148
	Chennai	Bangalore	1.96403	1.80948	.523	-2.2847	6.2127
		Hyderabad	-3.18798	1.97051	.239	-7.8148	1.4388

*The mean difference is significant at the 0.05 level.

For the "total reliability" variable, commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-4.6139) and Chennai (-0.91399). This suggests that commuters in Bangalore perceived lower levels of reliability in their transportation systems compared to their counterparts in Hyderabad and Chennai.

In terms of "total responsive," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-4.29187) and Chennai (-2.35666). This indicates that commuters in Bangalore perceived lower levels of responsiveness in their transportation systems compared to commuters in Hyderabad and Chennai.

For "total comp," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-4.91204) and Chennai (-1.47555). This implies that commuters in Bangalore perceived lower levels of overall comfort in their transportation systems compared to commuters in Hyderabad and Chennai.

In relation to "total accessible," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-7.21641) and Chennai (-3.58768). This suggests that commuters in Bangalore perceived lower levels of accessibility in their transportation systems compared to commuters in Hyderabad and Chennai.

For "total courtesy," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-2.56173) and Chennai (-1.26377). This indicates that commuters in Bangalore perceived lower levels of courtesy from transportation staff compared to commuters in Hyderabad and Chennai.

In terms of "total credit," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-1.95842) and Chennai (-0.55689). This suggests that commuters in Bangalore perceived lower levels of creditworthiness in their transportation systems compared to commuters in Hyderabad and Chennai.

For "total communication," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-3.09539) and Chennai (-1.60093). This implies that commuters in Bangalore perceived lower levels of communication in their transportation systems compared to commuters in Hyderabad and Chennai.

In relation to "total security," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-3.03266) and Chennai (-1.57613). This suggests that commuters in Bangalore perceived lower levels of security in their transportation systems compared to commuters in Hyderabad and Chennai.

For "total understand," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-3.21307) and Chennai (-1.47479). This indicates that commuters in Bangalore perceived lower levels of understanding from transportation staff compared to commuters in Hyderabad and Chennai.

In terms of "total tangibility," commuters in Bangalore had significantly lower ratings compared to those in Hyderabad (-5.15201) and Chennai (-1.96403). This suggests that commuters in Bangalore perceived lower levels of tangibility in their transportation systems compared to commuters in Hyderabad and Chennai.

The post-hoc analysis revealed significant differences in service quality dimensions of between commuters in Bangalore, Hyderabad, and Chennai. Commuters in Bangalore consistently reported lower ratings across multiple dimensions compared to their counterparts in Hyderabad and Chennai. These findings indicate that there are specific areas where the transportation systems in Bangalore may need improvement to meet the expectations and needs of commuters. Addressing these areas of concern could potentially enhance the overall satisfaction and experience of commuters in Bangalore. Future research and interventions should focus on identifying and implementing strategies to improve reliability, responsiveness, comfort, accessibility, courtesy, creditworthiness, communication, security, understanding, and tangibility in the transportation systems of Bangalore.

Impact of Service Quality of Metro Rail on Customer Satisfaction

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.014ª	.000	-.001	.84867
a. Predictors: (Constant), SQ				

ANOVAª						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.110	1	.110	.153	.696ᵇ
	Residual	584.109	811	.720		
	Total	584.220	812			
a. Dependent Variable: Satisfaction						
b. Predictors: (Constant), SQ						

Coefficients a						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.203	.182		23.113	.000
	SQ	.016	.040	.014	.391	.696
a. Dependent Variable: Satisfaction						

The constant term in your model is 4.203. This means that when all independent variables (including "SQ") are zero, the predicted value of "Satisfaction" is 4.203.

The coefficient for the variable "SQ" is 0.016. This suggests that for every one-unit increase in "SQ," the predicted "Satisfaction" score increases by 0.016 units.

The standardized coefficient (Beta) for "SQ" is 0.014. This indicates the relative importance of "SQ" compared to

other variables in predicting "Satisfaction." It suggests that "SQ" has a relatively small impact compared to the other variables in the model when all variables are standardized.

The t-value of 0.391 and p-value of 0.696 associated with the "SQ" coefficient suggest that the relationship between "SQ" and "Satisfaction" is not statistically significant at conventional significance levels (like 0.05). In other words, there's insufficient evidence to conclude that the relationship between "SQ" and "Satisfaction" exists in the population.

Overall, based on these coefficients and their significance levels, it seems that "SQ" may not be a statistically significant predictor of "Satisfaction" in this model.

10. Summary of findings, suggestions
➢ Address Specific Demographic Needs: metro services to meet the needs of different demographic groups. For instance, efforts could be made to better serve students, who were found to exhibit lower levels of courtesy, by implementing programs or initiatives targeted towards them.
➢ Prioritize Security Measures: Recognize the importance of security and ensure that measures are in place to address concerns, particularly for newer users. This may involve increased surveillance, safety protocols, and awareness campaigns to instil confidence among commuters.
➢ Improve Understanding of Customer Needs: Work towards a better understanding of customer needs across all demographics. This could involve conducting regular surveys, gathering feedback, and implementing changes based on customer insights to enhance overall satisfaction.
➢ Consistent Quality of Service: Maintain high levels of reliability and satisfaction in areas such as billing accuracy, punctuality, and availability of information. Consistency in these aspects contributes to a positive perception of metro services among users and fosters trust in the system.
➢ Improve Overall Reliability: Maintain and further enhance the positive perception of metro rail services' reliability among users. Focus on consistently meeting high standards for billing accuracy, punctuality, adequate train availability, and timely service, as these aspects strongly contribute to user satisfaction and trust in the system.
➢ Address Demographic Specificities in Courtesy: Recognize and respond to demographic variations in courtesy levels among metro commuters. Implement targeted initiatives, especially for students, to improve courtesy levels, while also acknowledging the influence of factors like income and travel frequency on courteous behavior.

11. Conclusion
In this study an attempt has been made to identify the dimensions of service quality within the metro rail system, analyze their relationship with demographic factor and examine their impact on consumer satisfaction. The study identified various dimensions of service quality, including reliability, responsiveness, competency, courtesy, communication, security, accessibility, understanding, and tangibility. These dimensions are crucial aspects of the metro rail experience and play a significant role in shaping consumer perceptions and satisfaction levels.

The findings of the study highlighted the importance of considering demographic factors such as location, occupation, income, travel frequency, and age group when assessing service quality. These factors exhibit varying degrees of influence on different dimensions of service quality, emphasizing the need for targeted strategies to address the specific needs and expectations of diverse commuter groups.

Furthermore, the study reveals a strong relationship between service quality and consumer satisfaction. Consistently meeting high standards across all dimensions of service quality leads to increased satisfaction levels among metro users. This underscores the significance of prioritizing service quality improvements as a means to enhance overall customer experience and loyalty.

It is also observed the importance of prioritizing service quality initiatives within the metro rail system. By understanding the dimensions of service quality, analysing their relationship with demographic factors, and focusing on enhancing consumer satisfaction, Metro Rail Corporations can improve their competitive advantage and deliver a superior experience to commuters.

Thus, improving the quality of metro rail services requires a multifaceted approach that addresses the diverse needs and concerns of commuters across different demographic groups and regions. By recognizing and responding to demographic variations in courtesy, communication, security, and understanding among metro users, authorities can implement targeted initiatives to enhance overall satisfaction and trust in the system. Prioritizing security measures and maintaining consistent quality of service, including reliability and punctuality, are crucial steps in fostering a positive perception of metro services. Furthermore, efforts to better understand customer needs through regular

feedback and engagement can inform strategic improvements that align with the expectations of commuters. Drawing insights from high-performing regions and implementing best practices, along with localized outreach and engagement initiatives, can bridge the perceived quality gap between different metro systems. By facilitating knowledge sharing, benchmarking exercises, and localized improvement initiatives, metro authorities can work towards delivering a reliable, courteous, and accessible service that meets the diverse needs of commuters across all demographics and regions.

12. References

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