

Dimensional Multivariate Statistics on Quality Enhancement Systems Embraced for Rapid Transit Systems



Priyanka Prabhakaran, S. Anandakumar

Abstract: *The study revolves around effective quality practices embraced along the construction of a rapid transit system at the Chennai airport station concerning managers and comfort level satisfaction. It also aims to compare various dimensions of quality practices and satisfaction levels. A Dimensional survey on engineers and metro users was made and analyzed using SPSS software. The study includes mid-level managers and users of the rapid transit system at Chennai, Tamilnadu. The study has tracked down ten dimensions of quality practices such as work hardness, material standards, materials rates, alternate methods, design criteria, safety nature, structural efficiency, work efficiency, labour & work time, job satisfaction to mid-level Manager's job satisfaction. The study also identified the other ten dimensions such as traffic reduction, Reach on-time, Smart ticketing system, female coach, daily waver Fare, Vehicle strand area, elevators, Frequency of trips, workplace access, Rider Comfort concerning Metro User's satisfaction. Besides, the study also confirmed that there is a significant impact on the reduction in Traffic reduction, On-Time, Smart ticketing system and Vehicle Strand area. The critical dimensions of the study may help the stakeholders & management to implement effective quality practices in the construction works of rapid transit systems and Services Offered to the Public community.*

Keywords: *Quality Management, Rapid transit system, Highly viewed Dimensions, Mid-level Manager's satisfaction, Ride Comfort.*

I. INTRODUCTION

The Chennai Metro is a mass rapid transit system providing untiring commuter service in the city of Chennai, Tamil Nadu, India. CMRL is considered to be the third-largest metro system in India in comparison with Delhi and Hyderabad. The Metro rail system commenced its service in 2015 after partially opening the first phase of the project. The Chennai metro rail system has elevated stations and uses standard gauge. There are 42 trains in operation with four coaches in each train operating in the first phase.

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Construction of the first planned layout began in June 2009, which spanned the seven stations Koyambedu to Alandur over a distance of 10 kilometers and began operation on 29 June 2015. The operational stretch is from Chennai Central to St. Thomas Mount and Washermanpet to Chennai International Airport with a total operational network of 45.1 km making it the third-largest mass rapid system in India.

The frequently growing vehicular and passenger needs with constraints on the capacity of the existing network have resulted in a harder chaotic condition during peak hours of the day lead to the advancement in the construction of metro rail (CMRL 2014). Metro has emerged as a top with customer satisfaction in the surveys carried out by Trans link. Modern transportation organizations have shifted their focus from erection and expansion of the transport infrastructure towards how to intelligently maintaining them[9]. The area of study to the airport station at Chennai that is connecting on Chennai international airport near Phase I of the project, which consists of two corridors covering a length of 45.1 km is under construction. Metro Rail system is recognized as a modern, reliable, and safe and environment mode of transport system providing very high passenger capacity ensuring enhanced access with a decrease in congestion on roads.

II. RESEARCH GAP

The studies about quality practices in the construction of the rapid transit system were found more inclined towards western culture. Very few studies were found to support the Indian context. Therefore, the author would like to identify the void areas by studying Mid-Level Managers and Commuter's views on quality

III. OBJECTIVES

This study has embraced the following objectives:

- To identify the critical dimensions of quality practices embraced for the rapid transit system.
- To statistically measure the high-end factors of quality practices in the construction of the rapid transit system works to measure a significant difference of opinion among Mid-Level Manager's profile (Gender, Experience)
- To measure a significant difference of opinion among Commuter profile (Gender, Age, and User Type)

IV. RESEARCH METHODOLOGY

This study is approached with ten dimensions regarding Mid- Level Manager's satisfaction. Besides, the study is approached with ten dimensions concerning Rider Comfort. The Hypothesis model is adopted for ten dimensions of Manager's satisfaction as well as ten dimensions of Comfort Level Satisfaction. The significance of each factor is analyzed. The dimensions are Reduction of traffic congestion, Punctual reach, Smart ticketing system, Ladies coach, Fare, Underground parking facility, Lift provision,

Frequency of trips, Ease of access to workplace, Comfort level, execution difficulties, material specification's, price hike of materials, replacement methods, design requirements, safety aspects, structural resistance, onsite-efficiency, manpower & work time, satisfactory outcome.

Table- I: Proposed Hypothesis Table

Hypothesis	Dimension	Impact On Manager's Satisfaction	
		Significant	Insignificant
H ₀	Work hardness	Significant	Insignificant
H ₁	Material standards	Significant	Insignificant
H ₂	Materials rates	Significant	Insignificant
H ₃	Alternate methods	Significant	Insignificant
H ₄	Design criteria	Significant	Insignificant
H ₅	Safety nature	Significant	Insignificant
H ₆	Structural efficiency	Significant	Insignificant
H ₇	Work efficiency	Significant	Insignificant
H ₈	Labour & work time	Significant	Insignificant
H ₉	Job satisfaction	Significant	Insignificant
Hypothesis	Dimension	Impact On Comfort Level Satisfaction	
		Significant	Insignificant
H ₀	Traffic reduction	Significant	Insignificant
H ₁	Reach on-time	Significant	Insignificant
H ₂	Smart ticketing system	Significant	Insignificant
H ₃	Female coach	Significant	Insignificant
H ₄	Daily waver Fare	Significant	Insignificant
H ₅	Vehicle strand area	Significant	Insignificant
H ₆	Elevators	Significant	Insignificant
H ₇	Frequency of trips	Significant	Insignificant
H ₈	Workplace access	Significant	Insignificant

H ₀	Rider Comfort	Significant	Insignificant
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VI. SURVEY METHODS

A data survey was accomplished by the questionnaire method. The Survey enlists the demographic profile of the Transit commutator. The survey also includes commuters profile and knowledge relevance about the progress of the work in site for Mid-Level Manager's views. The questionnaire on commuter views points to Rider comfort. Suitable alternatives were adopted in the existing survey to suit the purpose of the current study.

A. Descriptive statistics

On a total of 250 questionnaires, only 150 respondents were from Mid-Level Managers. The response rate was 68% percent. Among the survey conducted 6 were deputy managers, 22 were structural engineers, 6 were billing staff, 12 were safety personals, 25 were planning officers, 33 were site engineers, 9 were Senior engineers, and 09 were assistant engineers.

The demographic profile of Transit service users in the questionnaire features their age, gender, and Profession and user type. Out of 120 questionnaires, only 98 response was received from the service users. The response rate was found to be 82 % percent. Out of all the respondents, 22 were Software Professionals,6 were Bank Managers,7 were Professor,4 were Medical Staff,17 were Business personal,12 were housewives,39 were Students.

VII. ANALYSIS AND DISCUSSION

The analysis focuses on identifying the possible affinity between the construction works of transit system and the dimensions -work hardness, material standards, materials rates, alternate methods, design criteria, safety nature, structural efficiency, work efficiency, labor & work time, job satisfaction for successful quality management implementation that will have a direct impact on the work achievement level of Stakeholders & Commuters.

Table-II: Gender Perception According to Mid-Level Manager's Satisfaction

S N	Variable Name	Mean Score		T-statistics	Sig
		Male	Female		
1	Work hardness	4.17	4.00	2.568	0.011*
2	Material standards	4.00	4.50	1.783	0.077
3	Materials rates	3.67	4.00	-0.207	0.837
4	Alternate methods	3.17	3.50	-0.820	0.414
5	Design criteria	3.50	4.50	1.248	0.214
6	Safety nature	3.83	4.00	-0.992	0.323



7	Structural efficiency	3.67	4.00	-1.434	0.154
8	Work efficiency	3.50	3.00	1.054	0.294
9	Labour & work time	3.83	3.50	-1.544	0.125
10	Job satisfaction	3.33	4.00	0.369	0.000* *

From Table 2 it is inferred that the First dimension i.e Work Hardness and tenth dimension i.e Job Satisfaction is the highest measured variable based on gender perception of Mid-Level Manager’s perception.

Table-III: Perception based on the experience of Mid-Level Manager’s Satisfaction

S N	Variable Name	Mean Score		T-statistics	Sig
		<5	> 5		
1	Work hardness	4.00	4.17	-0.297	0.776
2	Material standards	3.50	3.17	0.297	0.776
3	Materials rates	4.00	4.17	-0.548	0.604
4	Alternate methods	3.50	3.17	0.369	0.725
5	Design criteria	3.50	3.50	-0.548	0.604
6	Safety nature	4.50	3.67	0.797	0.456
7	Structural efficiency	1.00	3.00	-1.897	0.107**
8	Work efficiency	3.50	3.67	0.297	0.776
9	Labour & work time	4.00	3.67	-0.369	0.725
10	Job satisfaction	4.00	3.50	1.846	0.114

From Table 3 it is inferred that the seventh factor is highly significant relating to structural efficiency

VIII. STUDY INTERPRETATIONS

The transit user’s opinion on dimensions of Quality Practices in Construction Works of rapid transit system regarding Mid-Level Managers and Job satisfaction have been measured by 5 point scale with the help of ten variables in the study among gender, age, profession, user type have been calculated respectively and represented under Table 4- Gender Perception, Table 5 - Age Perception,& Table 6- User Type Perception.

Table-IV: Gender perception of Rapid Transit Service

SN	Variable Name	Mean Score		T-statistics	Sig
		Male	Female		
1	Traffic reduction	3.31	3.09	1.332	0.186
2	Reach on-	2.75	2.42	2.844	0.005

	time				
3	Smart ticketing system	2.37	2.31	0.342	0.733
4	Female Coach	1.49	1.31	1.908	0.058**
5	Daily waver Fare	2.62	2.64	-0.307	0.759
6	Vehicle strand area	2.12	2.27	-0.979	0.330
7	Elevators	2.65	2.47	1.202	0.232
8	Frequency of trips	2.37	2.16	1.490	0.139
9	Workplace access	2.74	2.91	-1.213	0.228
10	Rider Comfort	1.78	1.76	0.209	0.835

In Table 4 (Gender Perception on Rapid Transit service) the highest mean score value is noted against the first dimension i.e. Reduction in traffic and the least noted dimension is fourth dimension i.e. separate provision for Female Coach. Regarding the Views on the variables, there has been a significant difference in opinion between male and female commuters out of the ten dimensions.

Table-V. Age Perception of Rapid Transit Service

S N	Variable Name	Mean Score		T-Statistics	Sig
		<50	>50		
1	Traffic reduction	3.17	3.34	0.934	0.352
2	Reach on-time	2.64	2.55	-0.670	0.504
3	Smart ticketing system	2.41	2.17	-1.249	0.215
4	Female Coach	1.38	1.52	1.258	0.211
5	Daily waver Fare	2.65	2.55	-0.976	0.331
6	Vehicle strand area	2.09	2.45	2.252	0.026
7	Elevators	2.59	2.52	-0.450	0.654
8	Frequency of trips	2.35	2.10	-1.514	0.133
9	Workplace access	2.81	2.79	-0.136	0.892
10	Rider Comfort	1.85	1.55	-1.972	0.052**

In Table 5 (Perception based on age for Rapid transit service) the highest mean score value is noted against the first dimension i.e. Traffic Reduction and the least noted dimension is fourth dimension i.e. separate provision for Female Coach Regarding the dimensions, there has been a significant difference in opinion between male and female Commutators out of the ten dimensions.



Table-VI: User-type Perception of Rapid Transit Service

SN	Variable Name	Mean Score		T-Statistics	Sig
		Regular	Non-R		
1	Traffic reduction	3.16	3.28	-0.720	0.473
2	Reach on-time	2.64	2.59	0.423	0.673
3	Smart ticketing system	2.50	2.19	1.916	0.057* *
4	Female Coach	1.48	1.35	1.384	0.169
5	Daily waver Fare	2.55	2.70	-1.633	0.105
6	Vehicle strand area	2.14	2.22	-0.548	0.585
7	Elevators	2.54	2.61	-0.511	0.611
8	Frequency of trips	2.29	2.28	0.056	0.956
9	Workplace access	2.82	2.80	0.178	0.859
10	Rider Comfort	1.71	1.83	-0.875	0.383

In Table 6 (Perception based on age for Rapid transit service) the highest mean score value is noted against the first dimension i.e. Traffic Reduction and the least noted dimension is fourth dimension i.e. separate provision for Female Coach. Regarding the Dimension of the variables, there has been a significant difference in opinion between male and female Commuters out of the ten dimensions.

IX. CONCLUSION

This study has embraced ten dimensions of quality management practices. The dimensions are - traffic reduction, Reach on-time, Smart ticketing system, female coach, daily waver Fare, Vehicle strand area, elevators, Frequency of trips, workplace access, Rider Comfort. The highest and least viewed variables are Traffic Reduction and Separate Female Coach Provision. The highly significant dimension in Table - 1 is Provision for separate Female Coach (0.058) based on the gender perception of rapid transit system Service. The highly significant dimension in Table - 2 is Rider Comfort (0.052) based on the age perception of metro users. The highly significant dimension in Table - 3 is a smart ticketing system (0.057) based on the user type perception of metro users. All the highly noted significant dimensions were found significant at 5% level.

This study will be beneficial to the stakeholders and key personnel to embrace quality practices to take further corrective actions for the betterment of facilities in the upcoming phase – II of the Project.

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AUTHORS PROFILE



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 She is working as Assistant Professor at Kongu Engineering College, Perundurai, Erode district Tamilnadu. Previously served as Assistant Professor in Civil Engineering Department at SCMS School of Engineering and Technology, Karukutty, Kerala. Has handled areas like Construction technology, Sustainable Engineering, Management Information systems, Total Quality management, Building Information Management, Advanced Construction Techniques. Specialized in the field of construction Management with 5 years of experience in teaching. First rank holder & Gold Medalist - Batch 2015 in the specialization of Construction Engineering and Management at Kongu Engineering College, Perundurai,Tamilnadu . Lifetime member of Engineering professional society. Associate member at Institution of Engineers, India. Won Elite award in Research Writing course conducted by NPTEL Kharagpur. Attended various workshops on modelling using R, AMOS, SPSS, SEM. Currently pursuing research in the field of Rapid transit systems. Presented three and Published two papers in International Conferences. Presented paper at prestigious institutions like NICMAR,Pune, SRM Eshwari College of Engineering.Presented Real time project on Coconut shell tile manufacturing and their aesthetic purpose. Conducted courses on Statistical analysis using SPSS. Carried out real time research project on quality management of Construction works of metro rail project under Airports Authority of Chennai, Tamilnadu. Has keen research interest in the field of quality management of rapid transit systems.



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