

Kerala State Road Transport Corporation Performance Analysis and Ranking of Depots

Sreeraj K R and Jayasree N

Abstract--- KSRTC was formed with the objective of providing adequate, efficient, economic and properly coordinated passenger service to the people of Kerala. Even after of 78 years of existence, one can see that it has not achieved this objective in several respects. This large public sector corporation was considered as a big drain in the Kerala economy, because of the huge loss it was incurring year after year. The main aim of this thesis work is to identify the passenger's perception towards KSRTC and conduct a quantitative analysis between depots and rank them according to their performance. The collected data is analyzed by means of adequate statistical methods. Depots are ranked using the response from the passengers and quantitative data collected from the depot. Depot's are then categorized as Depot's, sub depot's and operating centre's and the performance was analyzed. The low ranked depot's are then compared to the high ranked depot's and methods are suggested to the low rank depot's to get par with the high ranked depot's.

Keywords--- KSRTC, Performance, Passenger Perception, Quantitative Factors, Statistical Methods

I. INTRODUCTION

Public transport should become a vital part of a solution for sustainable transport in the future. In order to keep and attract more passengers, public transport must have high service quality to satisfy and fulfill more wide range of different customer's needs. It is important to get knowledge about what drives customer satisfaction in public transport

area to design an attractive and marketable public transport. At the same time to know more about how efficient and effective is the system. The focus of this thesis is Kerala State Road Transport Corporation(KSRTC).

In many of the countries around the world public transport sector occupies an important position in the economy. Customer satisfaction surveys are tools for capturing consumer perceptions of service. To meet customer requirements, it is fundamental to provide good basic public services, such as public transport and social security, which are subject to different situations and performance standards than private sector companies. Different service attribute plays important role in determining the level of quality of service. As a consequence, passengers' perceptions of the overall service depend on how they perceive the different service attributes. Over the last few years companies rely mainly on customer satisfaction and service quality. And this strategy turns to be more profitable for the companies. Public transportation is being used by above 70% and above population of our country. In India all the state road transport corporations are aligned under one umbrella by the Association state road transport undertakings. ASRTU has 62 STU members having a fleet strength of 122770 serving 75 million people and giving employment to 1 million people along the length and breadth of the country.

From 1937 onwards KSRTC has been serving the people of Kerala. KSRTC was formed with the objective of providing adequate, efficient, economic and properly coordinated passenger service to the people of Kerala. Even after of 78 years of existence, one can see that it has not achieved this objective in several respects. This large public

Sreeraj K R, M. Tech, Student, Government Engineering College, Thrissur, Kerala

Jayasree N, Associate Professor, Department of Production Engineering, Government Engineering College, Thrissur, Kerala

sector corporation was considered as a big drain in the Kerala economy , because of the huge loss it was incurring year after year. KSRTC with 28 Depots, 44 Sub depots , 20 Operating centres and fleet strength 6102 (employess) hold the backbone of transportation system along the length and breadth of Kerala.

There are depots having average daily collection above 10lakhs and at the same time below 1 lakhs . But even if passengers prefer more on our corporation the performance was not up to the expectations. This public sector is incurring huge loss, even in places where private buses earns huge profit. There are many routes where KSRTC holds the monopoly . It has reduced to only some of the districts. Even after that this corporation is one among the most companies incurring huge loss through out the last few years in the state.

Even a big point to be discussed is that even after being one of the biggest PSU it only operates 30% of the passenger buses and rest all leaving to the private bus operators. It is very much true that there are many new buses , new schedules every year but even after that the performance of the sector is declining as ages are coming. So the performance evaluation of the corporation is a main concern. For that performance evaluation in terms of service quality as well as the efficiency and effectiveness is required. For the last 78 years KSRTC has been serving the people of Kerala . Kerala State Road Transport Corporation was formed with the objective of providing adequate, efficient, economic and properly coordinated passenger service to the people of Kerala. Even after 78 years of existence, one can see that KSRTC has not achieved this objective in several respects. This large public sector corporation was considered as a big drain in the Kerala economy , because of the huge loss it was incurring year after year. KSRTC with 28 Depots, 44 Sub depots , 20 Operating centres and fleet strength 6102 hold the backbone of transportation system along the length and breadth of Kerala.

There are depots having daily collection above 10lakhs and at the same time below 1 lakhs . But even if passengers prefer more on our corporation the performance was not upto the expectations. This public sector is incurring huge loss, even in places where private buses earns huge profit. First the base should be cleared so detailed look into the depots is necessary . So the performance evaluation of the corporation is a main concern. For the performance evaluation quantitative and qualitative measures are necessary . The main objectives

- Study the functioning of KSRTC
- Identify the customer perception towards the public transport
- Performance analysis and ranking of depots
- Comparing the performance with the high performing depots and low performing depots of the state.
- Priorities for possible corrective actions or improvements and Suggestions based on the findings of the study

II. LITERATURE REVIEW

Adris A Putra(2004) defined in his paper a set of qualitative factors that effect the performance of a public transport system and also how the factors are selected and what is the passenger over view about these factors.

Eboli and Mazulla (2007) investigated service quality attributes important for customer satisfaction. Respondent were asked to rate the importance and satisfaction with 16 service quality attributes (availability, route characteristic, frequency, reliability, bus stop furniture, bus overcrowding, cleanliness, cost, information, promotion, safety on board, personal security, personnel, complains, environmental protection and bus stop maintenance). The result shows that the variable important for global customer satisfaction is service planning which is reflected in reliability, frequency, information, promotion, personnel and complaint.

Performance measures for public transit mobility management, Lalith sen Saramsitha rina explains about the factors affecting the service attributes and the attributes selected and they concluded saying it effects the performance.

According to Rahaman and Rahaman (2009) overall satisfaction has a direct relationship between twenty service-quality attributes. Using analysis methods they have found that overall satisfaction depended on eight service quality attributes. What was the expectations of the passengers towards the transport sector is explained by Sezhan, C.Muralidharan,T.Nambirajan,S.G. Deshmukh(2011) attributes later divided into 2 factors effecting the performance.

Kolanovic et have presented the methods of choosing the possible attributes affecting the service quality in port. Using PCA analysis they reduced the components into two and found out the performance.

III. METHODOLOGY

A set of 50 service attributes were used in this study. Data collected using a questionnaire a commonly used technique. Data analysis using SPSS software. Another set of 13 factors were used to calculate the quantitative data. Solved using mathematical techniques. The questionnaire was divided into two parts : first part demographics , which basically includes the name, age , sex, depot they belonged to and the occupation . Second part attributes measuring the satisfaction level of the passengers. A set of 50 attributes were given in the questionnaire Among the depots, 22 of them which had a daily collection between 1 -10 lakhs were chosen for the case study. Questionnaire was distributed through out the selected 22 depots along the state and responses are collected. A minimum of 10 responses was collected from each depot. Passengers where asked to scale the questions on Likert's 5 point scale (very bad to very good) .

Data were collected by handing over the questionnaire to the passengers in the depots and inside the bus according to the opportunity obtained. All the data's were collected back soon after when its completed. All those responses are sorted depot wise starting from one side. Depots were given codes starting from 1 to 23 in SPSS and responses were coded to it for analysis.

For quantitative analysis a data collection form was made which covers all the data needed for the thirteen factors founded out. Visited the Station master or The Controlling inspector of every depot and they helped us to complete the data collection form. Factors were calculated using these data's obtained.

SPSS software is used for the data input and for the data analysis . Reliability analysis to be done the value of chronbach's alpha should be higher than 0.6. SPSS software offers“reliability analysis statistic”, Reliability analysis allows you to study the properties of measurement scales and the item that make them up. The reliability Analysis procedure calculates a number of commonly used measures of scale reliability and also provides information about the relationships between individual items in the scale. Then after that validity is to be tested using bivariate analysis and in that the correlation between the factors should be as prescribed.

Data analysis is done using dimension reduction method factor analysis principal components. All the service quality attributes were reduced to different factors according to the similarities of the attributes. Weighted score for the each factors calculated. Component rotated matrix is taken and the components having high correlation values are taken. It is then multiplied with the total variance obtained and thus score can be obtained. Now the response score obtained for the each factor is multiplied with the weighted score to get the ranked score and thus the rank.

Thus the best performing depot's are identified. From the data's obtained 13 factors has been identified for evaluation and the factors are;

- **EPKM:** Total collection of the depot to that of the kilometer scheduled for the depot.
- **EPB:** Total collection of the depot to that of the kilometer operated .
- **MSD:** It is the overall sum of Maintenance charges with Diesel consumption of the depot with the Salary released for the workers.
- **Passenger Ratio:** It is the ratio between the total passengers travelling to that of the population of the locality were the depot locates.
- **Bus Ratio:** It is the operated schedule to that of the total no of buses of the depot.
- **Kilometer Ratio:** Kilometer operated to that of the total kilometer allowed to operate
- **Failure Rate:** It is the measure of how much kilometers being lost due to the meachanical or any other failures caused to the vehicles
- **Vehicle Revenue per Capita:** Operated kilometer to that of the total passengers
- **Passenger per Vehicle:** No of passengers travelling in a bus
- **Nearby Depots:** It is the distance of a depot to that of a nearby depot. The value can be used to estimate the performance.
- **Bus Demand and Requirements:** No of buses with in the depot and to that of the operated buses.
- **Cancelled schedule**
- **Schedule ratio:** Operated schedule to that of the total schedule.

IV. RESULTS AND DISCUSSIONS

Collected the data obtained from the field survey.The attributes are:

Communalities		
	Initial	Extraction
Bus punctuality	1.000	.430
Stopping bus at the correct place	1.000	.761
Availability of reservation services	1.000	.665
Waiting time for bus to come	1.000	.509
Service time helpful	1.000	.710
availability of night service	1.000	.626
Reliability of service to be on time	1.000	.249
Reserved seats to be retained by themselves(handicapped etc)	1.000	.738
Availability of buses	1.000	.789
Usage of new buses by your depot satisfactory	1.000	.553
availability of service to area you want to reach	1.000	.723
Bus stop near home	1.000	.792
Depot give service covering max area in length and breadth	1.000	.639
Bus route satisfactory	1.000	.844
Time taken to reach the destination according to distance	1.000	.509
Comfort of seat on buses	1.000	.770
Lighting inside the bus	1.000	.455
cleanliness inside the bus	1.000	.482
Luggage provision	1.000	.460
Availability of seat inside the bus	1.000	.093
condition of window	1.000	.810
Exterior and interior look of the bus	1.000	.579
Leakage from top (rainy season)	1.000	.639
Ease of getting in and out of the bus	1.000	.540
The bus you are going obey traffic rules	1.000	.730

Figure 3.1: Commuality (a)

Communalities		
	Initial	Extraction
Security inside the bus	1.000	.818
Driver obeys traffic rules	1.000	.764
Security in depot during the night time	1.000	.471
Help from the authoritics regarding your security	1.000	.557
First aid availability	1.000	.858
Kartc better than private bus in case of security	1.000	.532
Driving skills of the driver	1.000	.747
Behaviour of the driver and conductor	1.000	.766
Appearance of the staff inside the bus	1.000	.907
sufficient information given by the staff inside the bus	1.000	.847
involment of staff incase of reserved seat disputes	1.000	.477
Returning the balance of the ticket fare	1.000	.676
Response against the complaints against the corporation	1.000	.724
Behaviour of staff in the depot	1.000	.816
Availabity of destination timing inside the bus	1.000	.820
Capability of the staff inside the bus to give information about the route	1.000	.760
Details of the bus route in the depot	1.000	.663
Details about the timing in the depot	1.000	.782
Details about the ticket fares	1.000	.507
Cancellation of services and the necessary steps to be taken	1.000	.807
Announcement effective in depot	1.000	.526

Figure 3.2: Commuality (b)

	Initial	Extraction
Availability of toilets in the depots	1.000	.431
Cleanliness of the depots	1.000	.857
Details about the new service available	1.000	.850
Spacing among the seats	1.000	.705

Extraction Method: Principal Component Analysis.

Figure 3.3: Community(c)

Communality which is the total amount of variance a variable shares with all other variables being considered. The communalities may be viewed as whether the variables meet acceptable levels of explanation. A small communality figure shows that the factors taken together do not account for the variable to an appreciable extent. On the contrary, large communality figure is an indication that much of the variable is accounted for by the factors. The communality value should be greater than 0.4. The above table (4.2) shows the results obtain through factor analysis. Each value under column extraction shows the percentage of similar response by the passengers against each attributes. The value for Route characteristics factor shows that 97.7% passenger found with similar response about this attributes. It is 87% for the behavior of employee / staff and customer information factors for others oriented through a process called rotation. In this case study varimax rotation – most popular o factor rotation method is used, which tries to achieve simple structure by focusing on the columns of the factor loading matrix

Above table shows the results obtain from the factor analysis after rotation of factor matrix. The method used for rotation of factors is varimax an orthogonal rotation. From this it can identify the attributes those have to extract by analysis. In this way 6 factors identified considering the high correlation with the components . So here using the components extracted 39 attributes were classified under the 6 factors.

As all the thirty nine variables are considered, a coefficient or weight, W_i ($i = 1$ to 39) is obtained by multiplying the loadings in Table 3 on each component by the percentage of variance as seen in Figure 4.3, explained by the component

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	10.015	20.031	20.031	10.015	20.031	20.031
2	6.087	12.175	32.205	6.087	12.175	32.205
3	5.542	11.083	43.288	5.542	11.083	43.288
4	3.977	7.954	51.243	3.977	7.954	51.243
5	3.588	7.176	58.419	3.588	7.176	58.419
6	3.250	6.499	64.918	3.250	6.499	64.918

Figure 3.4: Total Variance

The table above shows the concept of determination of the number of factor those have to extract for subsequence analysis. From the above it can explain that the number of factors extracted is 6 . It can be also seen that those 6 factors cover around 64.9 % of total variance of the transportation service

It is desirable to reorient the factor solution so that the factor loadings matrix exhibits something close to simple structure so that the factors are easier to interpret. The factor solution is

$$\text{Weighted score}(W_i) = [\text{Loadings} * \text{Total variance}]$$

Each weight is then multiplied by the mean value of the respective attribute for each depot. These are then summed up to get the corresponding depot scores. Where, $i = 1$ to 39 and M_i – the mean value of each criteria. Based on the scores, the final ranking is obtained and presented in Table 4.3.

Total score = Weighted score (Wi) * Mean value (Mi)

Customer employee relationship (Component 1)

Table 3.1: Attributes Classification

Attribute	Weighted score
14	.138
15	.102
16	.132
27	.150
28	.117
33	.113
35	.168
36	.146
37	.144
40	.140
47	.143
48	.160
49	.117

Route characteristics(Component 2)

Attribute	Weighted score
18	.077
19	.079
20	.010
21	.010
32	.075

Service characteristics(Component 3)

Attribute	Weighted score
1	.061
11	.060
25	.057
44	.098
45	.076

Comfort and safety(Component 4)

Attribute	Weight score
3	.055
4	.040
5	.051
13	.055
22	.055
50	.071
51	.051

Depot Characteristics(Component 5)

Attribute	Weightd score
2	.055
7	.042
38	.040
34	.050
9	.041

Exterior / Interior measures(Component 6)

Attribute	Weighted score
29	.052
8	.037
43	.037
46	.045
12	.047

Total score for each depot's are calculated and ranked according to their category. Category rank(CR) and original rank(OR)

Sub Depot's	CR	OR
N Paravur	1	5
Malappuram	2	6
Adoor	3	7
Angamaly	4	9
Mala	5	12
Mannarkad	6	13
Kothamangalam	7	15
Guruvayur	8	16
Perinthalmanna	9	18
Chalakydy	10	20

Depot's	CR	OR
Chengamur	1	1
Changanassery	2	3
Tiruvalla	3	4
Aluva	4	8
Kayamkulam	5	14
Perumbavur	6	17
Muvattupuzha	7	21

Operating Centre	CR	OR
Pandalam	1	2
Kodungallur	2	10
Irinjalakuda	3	11
Puthukad	4	19
Vadakkenchery	5	22

Figure 3.4: Categorized Rank(Qualitative)

Now from the corresponding values of the quantitative factors obtained from the depot the highest and the lowest value is noted. Mean of these highest and the lowest values was being calculated. And the main aim for this calculation is to convert all these values into a common 5 point scale. For that with the help of these two high and low values around 7 intervals is being calculated out and then divided into 5 point scale.

Here the thing to be noted down is that some factors are having a positive impact and some are having a negative impact on the score. So those factors should be noted down a change in the scale is to done. So that we can make it more appropriate and accurate.

EPKM	
1	27.140-28.955
1.5	28.955-30.77
2	30.77-32.585
2.5	32.585-34.40
3	34.40-36.215
3.5	36.215-38.03
4	38.03-39.485
4.5	39.485-41.66
5	41.66

Figure 3.5: Quantitative Score

Thus calculated the score for each depot's and then ranked according to the obtained scores

Sub Depot's	CR	OR
Adoor	1	2
Perinthalmanna	2	3
Mala	3	4
Malappuram	4	8
Kothamangalam	5	9
Mannarkkad	6	11
N Paravur	7	17
Chalakudy	8	18
Angamaly	9	19
Guruvayur	10	20

Operating Centre	CR	OR
Pandalam	1	6
Puthukkad	2	7
Irinjalakkuda	3	10
Kodungalhur	4	12
Vadakkenchery	4	21

Depot's	CR	OR
Chengannur	1	1
Changanassery	2	5
Muvattupuzha	3	13
Kayamkulam	4	14
Perumbavur	5	15
Tiruvalia	6	16
Aluva	7	22

Figure 3.6: Categorized Rank(Quantitative)

After observing the ranking trends in both the analysis we can come to the final stage to sum up the values of both analysis and to find a final score and rank for the depots

Sub Depot's	CR	OR
Adoor	1	2
Perinthalamanna	2	3
Mala	3	4
Malappuram	4	7
Kothamangalam	5	10
Mannarkkad	6	11
Guruvayur	7	15
N Paravur	8	16
Chalakydy	9	19
Angamaly	10	20

Operating Centre	CR	OR
Pandalam	1	6
Puthukkad	2	8
Irinjalakkuda	3	9
Kodungallur	4	12
Vadakkenchery	4	21

Depot's	CR	OR
Chengannur	1	1
Changanserry	2	5
Perumbavur	3	13
Kayamkulam	4	14
Muvattupuzha	5	17
Perumbavur	6	18
Aluva	7	22

Figure 3.7: Categorized Rank (Final)

KSRTC	Qualitative rank	Quantitative rank
Chenganur	1	1
Adoor	7	2
Pandalam	2	6
Perinthalamanna	18	3
Changamasery	3	5
Mala	12	4
Truvalla	4	13
Malappuram	6	7

Figure 3.8: Comparison of Ranking with Qualitative and Quantitative Ranking

V. CONCLUSION

This thesis has presented a multi headed approach for KSRTC, aimed at helping the company management to formulate their strategies.

In today's INDIA privatization of government owned sectors is at its high levels, lot of public sector units has already been privatized. So when it comes to the public sector bus services the situation is little worse they are having a stiff competition with the private bus owners throughout the country

. Hence it becomes increasingly relevant that they formulate policies and strategy to suit the needs of the situation. Thus this study has its own position because it helps to understand the perspective of passengers towards this Public sector unit in terms of the service quality and also a detailed look at how the management is utilizing the resources and operating the system.

Six service factors obtained from the study as customer characteristics have all been found significant . Each factor has a good correlation value with overall satisfaction , using the attributes scores for each depot's are calculated and a rank list is prepared. It was then categorized according to Depot's , Sub depot's and Operating centre.

Thirteen factors were Quantitative analysis is done using mathematical formulas , important factors were identified and scores for each depot's are calculated . Final rank list with detailed score was obtained. As a final part both the scores from service quality factors and quantitative factors are added to obtain the final rank list for the depot's.

From the results we can conclude that depot's-20,21,18,19,9 were the best performing depots when considering the service quality attributes, depot-1,16,11,10,4 were the worst. Sub depot's and depot's performed better than operating centre from the view point of the customers.

When considering the qualitative factors the system changes here depot's-20,22,4,8,18 came out as high performing depot's and depot's-13,1,5,12,11 were the worst. Here the scenario changed because as a group Sub depot's performed better than both depot's and Operating centre's.

So by considering the both results we can come to the conclusion that depot's 20,22,4,8,18 were high performing depots and depot's - 13,1,12,11,14 low performing. As a group when it comes to the final lap Sub depot's were performing better than the other two. Depot's- 13,1,12,11,4 needs immediate attention on all the criteria for improvement. The managerial implication of this methodology is that it has given a clear insight into the customer preferences and perspective. The nineteen factors(service and quantitative) enlisted in this work have found importance from the passengers i.e., to the facilities and comfort as well as the responsibilities which the company ought to take up and also the data's developed. This gives a clear indicator to the management that it needs to come up with action plans both short term and long term to meet the expectations of customers. If the customers' feedback is appropriately acted upon, in turn it may be a customer retention strategy (short-term benefit) and will bring in more customers to patronize the transport in future, i.e., customer development strategy (long-term benefit).

From the result the lowest ranked depot was Aluva. The depot had a better customer perception value but fails to meet the quantitative factors. Above 20+ schedules were daily cancelled by the authorities. Failure rate was much more compared to the other depot's. At the same time the depot is having a huge number of non running buses in their garage. These factors effected the performance of the depot. When we consider the case of Depot's , Sub depot's and Operating centre's it can be clearly understood that Sub depot's with a medium level of facilities compared to the other two was performing better

REFERENCES

- [1] Eboli, L. and Mazzulla, G. (2007). Service quality attributes affecting customer satisfaction for Bus Transit, *Journal of Public Transportation*, Vol. 10 (1), pp. 21-34.
- [2] Sezhan.M.V,C.Muralidharan,T.Nambirajan,S.G Deshmukh(2011), Ranking of public sector bus transport company using PCA analysis ; A case study, *Management Research and Practise* Vol. 3 Issue 1 (2011)
- [3] Rahaman, R.K. and Rahaman, Md.A. (2009). Service quality attributes affecting the satisfaction of passengers of a selective route in southwestern Bangladesh, *Theoretical and Empirical Researches in Urban Management*, Vol. 3(12), pp. 115-125.
- [4] Performance measures for public transit mobility management, Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration. Lalith sen and Saramsitha rina
- [5] Transportation System Performance Analysis Urban Area Public Transport, *International Refereed Journal of Engineering and Science (IRJES)* Adris.A.Putra
- [6] Customer based port service quality, Department of Distribution Logistics , Croatia, Ines Kolvanic