

Conclusion on BRTS Evaluation by Fuzzy AHP

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Abstract—Transportation is the backbone to the development of country. It helps in functioning of urban areas efficiently by providing access and mobility. Passenger has an overriding influence on the functioning of the city. With growth, the mobility needs to be increased. The mobility can be increased in two ways, by encouraging private transport services like auto-rickshaw, private buses, and taxis or by public transport systems. Instead of private transport system we can choose public transport system because urban sprawl and poor land use planning contribute substantially to traffic congestion, air pollution, and greenhouse gas emissions. And public transport helps in reduction of sprawl by attracting development around transit stations, and this development also supports public transport by encouraging ridership. Hence transportation and community planning officials throughout the world examined improved public transportation in addressing their urban mobility issues. Public transport system is a key component of development of any country. Modal share of public transport is declining in most of cities due to various problems related with public transport such as tremendous increase in number of accidents, environmental degradation, Congestion; Overcrowding due to inadequate system, Frequency of service and schedule is not strictly adhered.

Keywords: BRTS, Fuzzy AHP

I. BUS RAPID TRANSIT SYSTEM (BRTS)

BRTS is a public mode of transportation providing high capacity and consuming cleaner fuels. It also has any comfortable and luxurious facilities with high technology functions for faster and safer travel, including exclusive busway, convenient stations, comfortable articulated buses, and Intelligent Transportation Systems (ITS) such as signal priority system, automatic fare system, Global Positioning System (GPS), bus arrival broadcast information, bus guidance, etc. Outstandingly, its investment cost is very effective, compared with other transit systems. India currently has a number of operational BRT systems in various cities like Ahmadabad, Pune, Delhi, Mumbai, Indore, Bhopal, Jaipur and Rajkot.

A. Objective and Scope of Study:

The Main objective of this study is to develop analytical hierarchical structure for performance evaluation of BRTS system.

II. ANALYSIS AND PROCEDURE

The analysis and process includes framework proposed there are four major stages for the performance evaluation of BRTS.

- 1) Identification of performance indicators
- 2) Development of hierarchical structure OF PERFORMANCE INDICATORS

- 3) Determination of local and global weightage of performance indicators
- 4) Determination of relative and absolute index of performance indicators of BRTS.

III. IDENTIFICATION OF PERFORMANCE INDICATORS:

Performance evaluation is done from three different perspectives, namely, financial perspective, Quality perspective and Quantity perspective. Financial perspective evaluation is done by the evaluation of Cost and Parking Cost. Quality perspective evaluation is done by evaluating indicator Reliability, User facilities, comfort. Quantity perspective evaluation is done by evaluating indicators like Accessibility, Frequency, and Occupancy ratio.

IV. DETERMINING WEIGHTS OF CRITERIA

To quantify the weight or the relative importance of various components identified, opinion survey of transportation professionals was undertaken. Questionnaire forms to take the expert opinion for the preparation of pairwise comparison matrix are prepared. Each expert was requested to complete the questionnaire. The questionnaire required experts to compare components at a certain level to each other with reference to their impact on the component at a higher level. Ten expert advices were taken in the analysis.

To determine the criteria and evaluate the performance evaluation of BRTS. According to their preferences, the performance evaluation of BRTS pair wise comparison.

Pair wise comparison matrix is formed by using expert opinion as shown in Table below;

A. Comparison matrices for criteria

Criteria	Quality perspective	Quantity perspective	Financial perspective
Quality perspective	(1,1,1)	(1/4,1/3,1/2)	(1/6,1/5,1/4)
Quantity perspective	(2,3,4)	(1,1,1)	(4,5,6)
Financial perspective	(4,5,6)	(1/6,1/5,1/4)	(1,1,1)

Table 4.1:

After taking the opinion of survey the next step is the geometric mean of fuzzy comparison values of each criterion is calculated and results are shown in Table

Criteria	Quality perspective	Quantity perspective	Financial perspective
Quality perspective	0.35	0.4	0.50
Quantity perspective	0.79	1	1.26
Financial perspective	2	2.46	2.88

Total	3.14	3.86	4.64
Reverse(Power -1)	0.32	0.26	0.21
Increasing order	0.21	0.26	0.32

Table 4.2: Geometric means of fuzzy comparison values

In the fifth step, the fuzzy weight of Quality Perspective criterion the relative fuzzy weights of each criterion are given in Table 4.3

Criteria	Quality perspective	Quantity perspective	Financial perspective
Quality perspective	0.0735	0.104	0.16
Quantity perspective	0.1659	0.26	0.4032
Financial perspective	0.42	0.64	0.9216

Table 4.3: Relative fuzzy weights of each criterion

In the sixth step, the relative non-fuzzy weight of each criterion (Mi.) is calculated by taking the average of fuzzy numbers for each criterion. In the seventh step, by using non fuzzy (Mi)s, the normalized weights of each criterion are calculated and tabulated in Table 4.4

Criteria	Mi	Ni
Quality perspective	0.11	0.105
Quantity perspective	0.27	0.260
Financial perspective	0.66	0.635

Table 4.4: Average and normalized relative weights of criteria

Criteria	Mi	Ni
Cost	0.73	0.74
Parking Cost	0.26	0.26

Table 4.8: Average and normalized relative weights of criteria

Criteria	Mi	Ni
Reliability	0.268	0.135
User Facilities	1.35	0.684
Comfort	0.356	0.181

Table 4.12: Average and normalized relative weights of criteria

Criteria	Mi	Ni
Accessibility	0.300	0.270
Frequency	0.193	0.175
Occupancy Ratio	0.607	0.555

Table 4.16: Average and normalized relative weights of criteria

V. RESULTS OF FUZZY AHP

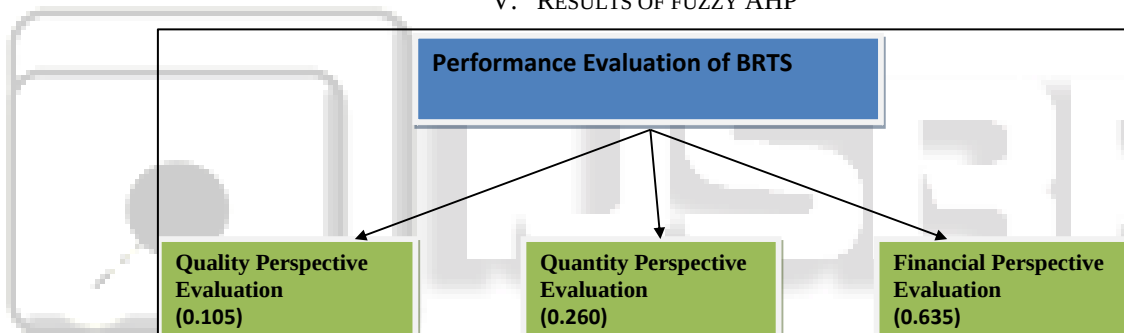


Fig. 4.1: Results of main criteria of Performance Evaluation of BRT

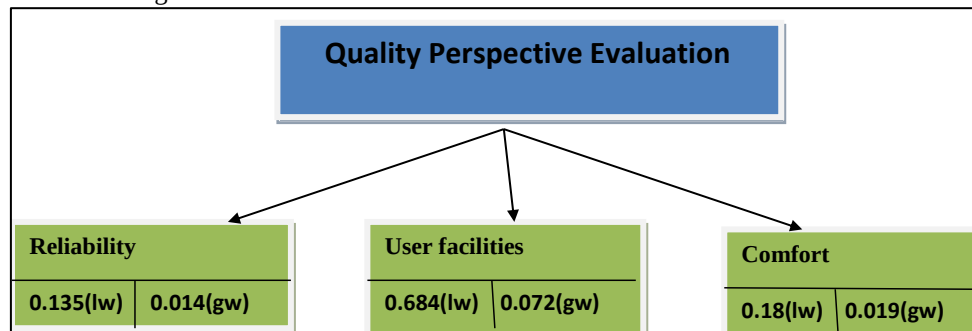


Fig. 4.2: Result of sub criteria of Performance Evaluation of BRTS

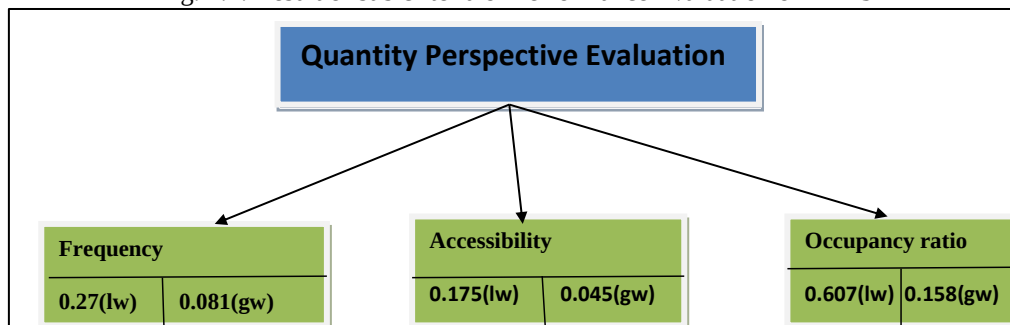


Fig. 4.3: Result of sub criteria of Performance Evaluation of BRT

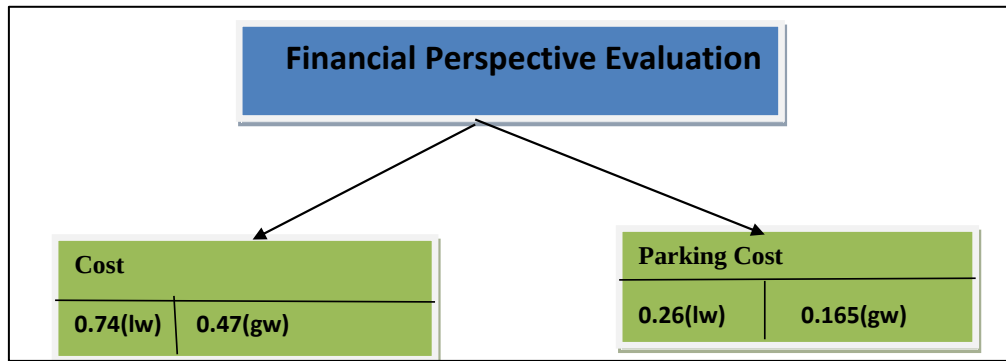


Fig. 4.4:

VI. CONCLUSIONS

The main objective of this study was to develop a methodology to evaluate the performance of Bus Rapid Transit Systems of Bhopal. The following conclusion may be drawn based on the study.

India currently has a number of operational BRT systems and many more under planning & some are under construction. Therefore it is necessary to evaluate the performance of BRTS in existing cities to how well it is providing transport service to the public in the area served, and provides valuable information based on which important operating decisions can be taken for implementing the BRT systems for other Indian cities.

Critical literature review indicates that there is a lack of performance evaluation systems in India for BRTS. Therefore there is an urgent need to develop a performance evaluation of BRT systems.

This study develops a hierarchical for performance evaluation of BRTS under separate categories and defining them separately so as to identify the issues related to each separately from Quality perspective, Quantity perspective and financial perspective.

The proposed methodology comprises of the following four stages

- 1) Identification of performance indicators
- 2) Development of a hierarchical structure of the indicators.
- 3) Determination of local and global weightage of performance indicators.
- 4) Determination of relative and absolute index of performance indicators

The performance indicators for the evaluation of BRTS are identified and separated under three different categories i.e., financial perspective evaluation, Quality perspective evaluation and Quantity perspective evaluation.

All the performance indicators identified, are not equally important for performance evaluation of BRTS. Fuzzy Analytical Hierarchical Process is used to determine the relative importance of weight at different hierarchical.

Financial perspective got weightage value of 0.635, Quality perspective got weightage value of 0.105 and Quantity perspective got weightage value of 0.260.

The comparative performance weightage for financial perspective evaluation show that financial Facilities weightage got highest value. The value goes in ascending order from Parking Cost fund balance and cost measures.

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