A Framework to Improve Bus Transit Service Quality Considering the Asymmetric Relationship between User Satisfaction and Service Level

Abstract

Improving transit service quality based on customer expectations is a key element in retaining existing and attracting future users. This has led to increased focus on assessment of service quality based on user's perception. Importance of service attributes to the users and evaluation of service performance based on user's perception are two primary perspectives in priority evaluation. Importance of service quality attributes is determined using either the stated or the derived importance approach. However, in context to developing countries, users' inexperience, along with their tendency to exaggerate the importance of every attribute, necessitates the requirement of a combined importance approach that identifies the criticality of an attribute. The second perspective to undertaking priority decisions is related to service performance. The most common measures are mean satisfaction values, gap analysis, user's Zone of Tolerance (ZOT) and Level of Service (LOS) scales. The concept of User Satisfaction Level (USL) curve is another way to determine attribute performance. It is a trend line that expresses the relationship between user satisfaction and service level. The proponents of Kano model state that the relation between service performance and user satisfaction is asymmetric. Methods like regression analysis and fuzzy c- means clustering are used to determine attribute characteristics. These methods however fail to provide any insight on either the threshold levels of service attribute performance or the increase in user satisfaction that result from service improvement. Thus, there is a need to integrate attribute performance and attribute characteristics to determine performance impact. In case of developing countries like India, public transit operators also need to provide quality service at an affordable price. This complexity necessitates the development of a comprehensive framework that enables transit operators to decide on what services to provide, how much to provide, and when to provide.

In this research, a list of transit service quality attributes based on user perspective is identified from literature, and then validated using a pilot survey of bus service users in Kolkata, Visakhapatnam and Rajkot. The second task involves prioritisation from the users' perspective, which loosely composes of three sub-tasks namely, determining the degree of criticality of the attribute, determining the impact of service performance on user satisfaction, and determining users' willingness to pay (WTP) for improved services. The degree of

criticality of service quality attributes is determined using a combination of stated and derived importance. User's stated importance is analysed using RIDIT analysis, and the derived importance is analysed using ordinal logistic regression (OLR). A ranking system is also developed for the significant service quality attributes using partial log likelihood (PLL). Finally, based on RIDIT score, and OLR significance, a novel criticality categorisation is developed. Next, the performance impact of the attributes is developed which classifies attributes into various levels of impact based on the attribute's characteristics and its existing performance. Three types of attribute characteristics have been identified: basic, excitement and performance. The attribute characteristics are determined based on the length of the upper and lower plateau, and the range of the linear portion of the USL curve. The location of the bend points on the USL curve are determined using mixed partial derivative of response variable.

In the last stage of the prioritisation process, quantitative attributes are prioritised using a criticality –performance impact matrix with different levels of priority. Attributes with similar level of priority are further ranked considering the cumulative percentage rate in change in user satisfaction and the users' WTP. WTP for improved service attributes is determined using binary logistic regression. Prioritisation of qualitative attributes is assessed using degree of criticality and mean satisfaction values.

The results obtained from the study observe that there exist differences between user's perceived importance and their satisfaction. In Kolkata and Rajkot, fare amount is perceived to be low importance though it has significant influence on overall satisfaction. It is also observed that though users perceive safety and security as an attribute of critical importance, they are unwilling to pay for safety and security related infrastructure. In Visakhapatnam and Rajkot, most attributes are characterised as excitement attributes unlike in Kolkata, where most are basic attributes. There also exists similarity in priority results between Visakhapatnam and Rajkot where on- time performance of bus service needs to be improved; however, in Kolkata service headway requires improvement.

This study presents two novel methodologies to determine the degree of criticality of an attribute by combining stated and derived importance, and determine the performance impact of an attribute considering its current service level and its characteristics. Each of these two methodologies can be used independently to determine attribute priority, and can also be used

in unison to develop a comprehensive criticality- performance impact analysis for improved attribute prioritisation.

Keywords: User perception, Degree of criticality, Performance impact, User Satisfaction Level