

An Investigation into the Urban Bus Route Performance using a Modified DEA Model: Application to Kolkata Bus Transport

Arnab Adhikari and Sumanta Basu

Operations Management Area

Indian Institute of Management Calcutta

Joka, Kolkata 700104, India

arnaba10@email.iimcal.ac.in, sumanta@iimcal.ac.in

Indranil Biswas

Operations Management Area

Indian Institute of Management Lucknow

Prabandh Nagar, Lucknow 226013, India

indranil@iiml.ac.in

Abstract

In this article, we investigate performance of the 21 bus routes of Kolkata, an urban city in India with the help of a Variable return to scale semi-oriented radial measure based modified data envelopment analysis (DEA) model. Existing scholarly works indicate that the route based performance evaluation in the context of urban bus transport is not provided enough attention. This paper shows context specific implementation of an advanced DEA model to capture both financial and operational efficiency. Conventional BCC-DEA model shows the limitation to handle data that take both positive and negative values due its non-negativity assumption of the inputs and the outputs. The proposed model overcomes this and presents an improved measure in case of financial performance measurement. Also, the model facilitates service efficiency measurement consistent with the conventional method. Our model recognizes route specific cost advantage or service efficiency in a better way compared to the conventional model for the loss-making routes or the routes operating at a break- even level. We extend our analysis into the bus route characteristics and explore that the extent of overlapping routes, reduction of road congestion, the proper workforce allocation, and the revision of the bus fare should be given utmost priority.

Keywords

Data envelopment analysis (DEA); Semi oriented radial measure based data envelopment analysis (SORM-DEA); Urban Bus Transport; Route based Analysis

Biography

Arnab Adhikari is currently a doctoral candidate of operations management area at Indian Institute of Management Calcutta. Prior to that, he worked in WIPRO Technologies for two years as a SAP consultant. He has done his engineering in Electronics and Communication engineering from National Institute of Technology, Durgapur, India. He is currently doing his thesis on designing coordination mechanism and risk hedging strategy for apparel supply chain. Apart from this, his research interests include innovative application of operations research techniques like DEA in real life problems, novel application of statistical tools and techniques in real life scenarios, transportation and logistics etc.

Sumanta Basu is an Associate Professor of Operations Management at Indian Institute of Management Calcutta. He holds a FPM degree in Production and Quantitative Methods, Indian Institute of Management Ahmedabad and a B.Tech (Hons.) in Chemical Engineering from Vidyasagar University. His primary research interests are in operations and supply chain management, operations research, and pricing and revenue management, etc. He has six years of work experience in petrochemicals industry and in IT industry before joining academics. He has published papers in journals like Omega, Journal of Revenue and Pricing Management, OPSEARCH, American Journal of

Operations Research, Decision etc. He has two US patents and one US patent application on his name for process improvements in BPO industry in collaboration with Wipro Technologies.

Indranil Biswas is an assistant professor of operations management area at Indian Institute of Management Lucknow. He has completed his PhD from Indian Institute of Management Calcutta. He worked in Hindustan aeronautics limited for four years. He has done his engineering in Electrical engineering from Bengal Engineering and Science University, West Bengal, India. His research interests focus on supply chain coordination, application of optimization techniques in healthcare value chain, voluntary sector, transportation etc.