A Meta-Heuristic Clustering Model to Optimize City-Logistics Resource Requirements considering First Mile and Last Mile Value Stream Map

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Abstract

In this study, we introduce a distribution network design problem to determine optimal resources required (vehicles, field executives) to operate a city-logistics network with a given distribution of sellers and customers. Since the last decade, the e-commerce market is characterized by enormous growth and changes. This growth has caused and still causes major inefficiencies within the delivery to customer part of the supply chain known as 'last mile'. On the other hand, pickup from the sellers, to bring goods into the supply chain also known as 'first mile' creates opportunities of marginal utilization in the city-logistics supply chain. Urban areas represent great challenges for logistic organizations for better economic efficiency in order to meet seller and customer requirements.

We initially investigated standard clustering techniques such as partitioning based clustering (k-means, k-mediods), hierarchical clustering (agglomerative, divisive) and density based clustering (dbscan, optics). Being a multivariate optimization problem, we develop a hybrid clustering model to generate time-constrained and resource-constrained clusters. These clusters also help to identify optimal hub locations to act as starting points for seller pick-up and customer delivery activities. This dynamic model will improve the productivity of resources considering the supply load variability and unpredictable demand nodes. The vehicular routing within a cluster to calculate the travel time is done using the meta-heuristic method of ant colony optimization (ACO). This clustering model will help to reorganize logistics more efficiently and deal with urban logistics challenges.

Keywords
City Logistics; E-commerce; Clustering; Resource Optimization

Biography

Syed Tanveer Ahmed is currently working as an Operations Research Analyst in Supply Chain Design for Flipkart India Pvt. Ltd., the largest e-commerce organization in India. He earned his B.Tech. in Electrical Engineering from Indian Institute of Technology (IIT) Bhubaneswar, India. He is now working to transform supply chain design through mathematical modeling and optimization and achieve the most simplified, 100% utilized, fastest supply chain network in the country. His research interests include soft computing, simulation, optimization and network design. He is a member of IEEE.

Sarvartha Kanchan is currently working as a Director of Supply Chain Design for Flipkart India Pvt. Ltd. He earned B.Tech. in Electronics and Communication Engineering from Technical University of Uttar Pradesh, India and Masters in Operations Management from ICFAI University, India. Sarvartha has worked in supply chain environment of highly regulated / process driven manufacturing companies like GE Healthcare, Britannia Industries Limited and complex logistics and warehousing domain with Flipkart. He has worked across different supply chain functions namely, Strategic Sourcing, Vendor Development, Process Engineering & Quality, Materials Management and Order Fulfillment. He was responsible for driving efficiency improvement projects in supply chain at a corporate level and was looking at end to end value chain for driving LEAN Six Sigma improvements. Currently he looking at transforming supply chain design to improve speed, reliability and cost for the logistics function of Flipkart. His interests include vendor development, manufacturing, simulation, optimization, design for six sigma and lean. He is member of ASQ, APICS, WERC.