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Transport optimization models for the downstream agricultural supply chain: A systematic review of literature

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Agricultural supply chains play a major role in the Sri Lankan economy as the agricultural sector accounts for 7.6% of the total gross domestic product and 26.6% of the total employment. Sri Lankan consumers have to pay more for vegetable products mainly due to the perishable nature of vegetables and the inefficiencies in the supply chain which is leading to high levels of wastage. According to previous research, 48% of post-harvest wastage happens during transportation. Some other factors that contribute to such waste include: packaging, storage conditions, communication of information, and excess supply. The objective of this study is to explore existing network optimization models for the vegetable supply chains in order to minimize cost and wastage levels. Factors that contribute to inefficiencies, prevailing policies and the current operating model of the downstream logistics in vegetable supply chain have been examined through a systematic review of 30 selected research papers. Various distribution network optimization models, tools and techniques that could be used for this purpose were reviewed through literature analysis. A framework was developed for distribution network optimization of vegetable supply chain in order to reduce wastage and increase the efficiency of the downstream logistics process. Based on the review of literature, Mixed-integer linear programming and integer programming were identified as widely used models for developing a three-stage optimized distribution network. Data regarding Cost, time, distance between distribution centres and retail locations and transported quantities are required to develop these models. In addition, simulation, genetic algorithms, heuristic and simplex are identified as potential techniques and CPLEX, Xpress-MP, GLPK and Supply Chain Guru are identified as tools that are capable of deriving optimal solutions by considering all the elected variables. In conclusion, this research discusses how the end consumer is benefitted by an optimized agricultural distribution network. Further, this research provides an insight into the currently available knowledge in the research area and acts as a guide for developing an optimized distribution network while suggesting the most suitable optimization models and techniques for future research on the agricultural supply chain in Sri Lanka.

Keywords: vegetable supply chain, distribution network, optimization models