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Cost minimization model through consolidation: application to a third party logistics distribution center

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Third Party Logistics (3PL) providing industry has become an essential service for the manufacturers due to the numerous benefits they could obtain by outsourcing their logistics activities to a 3PL provider. When considering the 3PL industry in Sri Lanka, growth can be seen in the past few decades. Since the distribution of goods of multiple clients in a 3PL Distribution Center (DC), is handled by the 3PL providers, they are much interested in minimizing the distribution cost which will not only ultimately benefit to the 3PL provider but also the client as well. However, managing the distribution of multiple clients at the same time with an optimized cost is challenging for 3PL service providers. The consolidation of goods of multiple clients in the distribution process is one of the main cost-effective strategies that the 3PLs could use. But due to several reasons such as compatibility constraint of goods transported, client concerns, complicated scheduling, consolidation is not practiced by many of the 3PLs in Sri Lanka. Therefore, this study was conducted on identifying the main factors to be considered when consolidating goods of multiple clients, and to develop a mathematical model to minimize the distribution cost in a 3PL DC by shipment consolidation. This paper proposes a mathematical model considering the Vehicle Routing Problem (VRP) as an extension found in the literature, where the compatibility of the products distributed has been added as a new constraint. The mathematical model has been tested and validated using the actual data obtained from few of the 3PL firms in Sri Lanka and has been simulated using the Supply Chain Guru Software. Different scenarios are created in the software to check the feasibility and accuracy of the model. The results obtained showcase an average cost reduction of nearly 25% when consolidating shipments of multiple clients in a 3PL DC. Therefore, it is evident from the study that, the 3PL firms could obtain a significant cost reduction by consolidating shipments of multiple clients. It was also identified that factors like compatibility of the distributed goods, cargo tonnage, clients' privacy concerns and scheduling of shipments should be considered when consolidating goods of multiple clients to distribute in a 3PL DC. The findings of this research will help the 3PL providers to consider consolidating shipments of several clients and the mathematical model proposed in the research will help them to minimize the distribution cost. Furthermore, the trucks can be properly utilized, the number of trucks and fuel wastage can be reduced and the impact on the environment will be lesser. Future researches could be done on adding more complexity to the model by considering different constraints such as time windows for the orders.

Keywords: Third party logistics, Consolidation, Vehicle routing problem, Simulation