An optimization system for procurement logistics including both the cost of ground rent and the cost of procurement logistics and including both the direct transportation model and the milk-run model

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A logistics system is very important for an e-commerce company because the logistics costs of such a company are higher than that of other retail business companies. In terms of procurement logistics costs, an e-commerce company bears the cost of ground rent and suppliers bear the costs of procurement logistics. There are two types of transportation models: direct transportation model and milk-run model. In direct transportation model, trucks pick up goods at one supplier's depot and directly deliver the goods to e-commerce company's depot. In milk-run model, trucks pick up goods from some suppliers and deliver them to the e-commerce company's depot in one journey. Other recent studies have included only the costs of ground rent or the costs of procurement logistics, have not created a simulation with real data or with many suppliers, or have included only the direct transportation model or milk-run model. This paper proposes an optimization system including both the costs of ground rent and the costs of procurement logistics and both the direct transportation model and milk-run model and simulates the use of a real e-commerce company including many suppliers. The sum of costs of ground rent and costs of procurement logistics is defined as the total cost. This system makes the total cost minimum.

This system chooses better transportation model for each supplier by calculating necessary amounts of goods needed per week from each depot. When the amounts need more than one 4t truck to be transported, the depot is applied direct transportation model. When the amounts need less than one 4t truck to be transported, the depot is applied milk-run model. In direct transportation model, the goods that are shipped in large quantities are defined as main goods. Up to five main goods are chosen from the largest order. This system optimizes a combination of truck capacity and order frequency for each type of main goods because the combination determines the total cost. The unused space of truck is calculated and other goods are transported by using this unused space. Goods which stock per sales is less are preferentially purchased and transported. In milk-run model, this system chooses coverage depots. Too far depots cannot be applied milk-run model because it takes long time to transport from such depots. Based on necessary amounts and geographical data, this system calculates suboptimal picking up route by using genetic algorithm. Then, order frequency is changed and suboptimal picking up route is recalculated. Thus, optimal combination of order frequency and picking up route is calculated.

This paper uses the real sales data of e-commerce company X. Beverage company A and other 49 companies are applied this system. The simulation period is three months. Beverage company A is applied direct transportation model and other 49 companies are applied milk-run model. In this case, about beverage company A, total cost is reduced by 40%. About other 49 companies, transportation model is changed from the past so cost comparison is difficult, but simulation indicates effective result and shows cost in worst scenario and cost in best scenario is very different.

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