

ABSTRACT

PT SNS (Sinar Niaga Sejahtera) branch Yogyakarta is the main distributor company under the leading consumer goods company (PT Garudafood Putra Putri Jaya) in Indonesia which distributes wide range of food and beverage products. The products are available in both modern market (mini-market and super-market) and traditional market. The efficient distribution process becomes more important to improve the company's profitability. In January – March 2015, PT SNS branch Yogyakarta spent approximately Rp 59,680,190 in total for fuel cost or Rp 19,893,396.67 averagely per month. The incurred cost in its distribution process is quite high compared to the price of product on market which quite cheap.

The mathematical model in this research is developed by using integer programming which can represents the actual condition of the company's distribution process. The objective function of the model is to minimize the total distance which impact to fuel cost, also the output will be the best route for delivering the finished goods to the end customers in Yogyakarta Province.

Due to the high number of customers in Yogyakarta, this system is categorized as NP-hard problem, consequently the exact method is not feasible to optimize the developed model. Then, the Metaheuristics Method is proposed to optimize the developed model. The proposed method in this research are Genetic Algorithm (GA) and Ant Colony Optimization (ACO). The both methods are chosen in order to be determine which one is the right method and resulting the optimal solution. Also, the Design of Experiments (DoE) is proposed in this research to determine the optimal value of each parameter for both method.

The first scenario is to optimize the actual condition by using GA and ACO for each vehicle route. The optimization for traditional market for one day period results that both ACO and GA could minimize the total distance for each vehicle. The result of optimization by using Genetic Algorithm (GA) is able to minimize total distance approximately 90 km or 11% and for ACO approximately 68.5 km or 8.4%. In term of financial analysis, the amount of fuel cost can be saved up to Rp 88,714 or 11% of the existing condition and for ACO, up to Rp 67,556 or 9.5%.

The second scenario is to optimize the distribution process by clustering the customers using k-means, which consists of 6 clusters. The result of optimization by using k-means clustering algorithm and Genetic Algorithm is able to minize the number of vehicle from 10 to 8 where each vehicle has load around 70% in average, and the total distance is 1020.23 km. In term of financial analysis, the total fuel cost is around Rp 778,373.50 where the existing condition is Rp 803,760.00 for 816 km which can be concluded that minimizing the total distance is not always able to minimize the total fuel cost.

Key words: CVRP, Supply Chain Management, Genetic Algorithm, Ant Colony Optimization