ABSTRACT

Nowadays, the complexity of the global supply chain is increasing. Thus, vehicle routing problem (VRP) has become a very important problem because of its practicality in real-world applications. Many customers have expectations that their demands should be delivered at a specific time interval, which is called time window. Thus, VRP with time windows (VRPTW) is more relevant than classical VRP in real-world applications. In addition, the green vehicle routing problem (GVRP) is an extension of the VRP that considers environmental impacts and harmonizing the environmental and economic costs. The environmental issue is important to be considered as part of the actions of taking care of earth sustainability. However, the increase in the supply chain complexity also leads to more vulnerability to disruptions. Resilience is described as the ability of the supply chain network to return to the initial condition after a disruption occurs, so all supply chain networks need to have resilience.

Therefore, a multi-objective method is processed to solve the disruption in two-stage VRPTW. There are two objectives of this study. The first objective is to minimize total supply chain cost, while the second one is to minimize the total supply chain carbon emission. This study consists of two stages. The first stage is the supply chain in ideal condition, while the second one is the supply chain in disrupted condition. This study proposes an improved MOPSO to solve the problem. As the fitness cannot decide which algorithm is better, this study uses the quality indicators to compare all of the algorithm. The decision that will be taken is the distribution of the supply chain system.

Based on the computational result, for small-, medium-, and big-size supply chain networks and low and high disruption duration, improved MOPSO has the highest hypervolume and lowest spacing. Thus, it can be concluded that the improved MOPSO is the best algorithm to solve disruption in the two-stage VRPTW.

Keywords: Vehicle Routing Problem with Time Windows, Green Supply Chain, Disruption Supply Chain, Multi-objective Particle Swarm Optimization.