

## 1. Problem description

The following description stems from Dzalbs & Kalganova (2020). The article is provided along with the data set. Beware: The task to be solved in the course differs from task described in the article.

The case study is inspired by a real-world dataset of an outbound logistics network provided by a global microchip producer. The company provided demand data for 9216 orders that need to be routed via their outbound supply chain network of 15 warehouses, 11 origin ports and one destination port (see Figure 1). Warehouses are limited to a specific set of products that they stock, furthermore, some warehouses are dedicated for supporting only a particular set of customers. Moreover, warehouses are limited by the number of orders that can be processed in a single day. A customer making an order decides what sort of service level they require – DTD (Door to Door), DTP (Door to Port) or CRF (Customer Referred Freight). In the case of CRF, the customer arranges the freight and company only incur the warehouse cost. In most instances, an order can be shipped via one of 9 couriers offering different rates for different weight bands and service levels. Although most of the shipments are made via air transport, some orders are shipped via ground – by trucks. The majority of couriers offer discounted rates as the total shipping weight increases based on different weight bands. However, a minimum charge for shipment still applies. Furthermore, faster shipping tends to be more expensive, but offer better customer satisfaction. Customer service level is out of the scope of this research

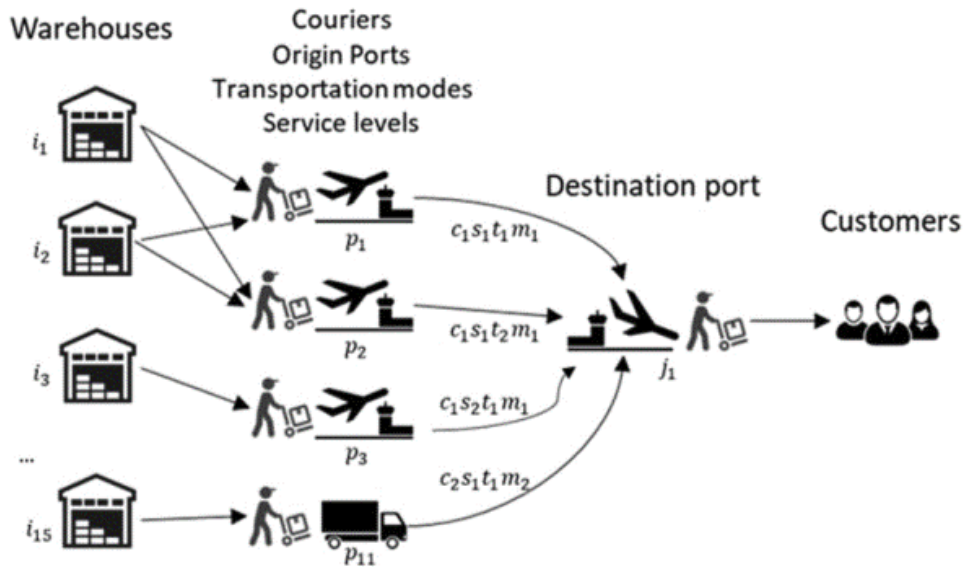


Figure 1: Sampled product on retail homepage and structure of the data set

Dataset is divided into seven tables, one table for all orders that need to be assigned a route – *OrderList* table, and six additional files specifying the problem and restrictions. For instance, the *FreightRates* table describes all available couriers, the weight gaps for each lane and rates associated. The shipping lane refers to courier-transportation mode-service level combination between two shipping ports. The *PlantPorts* table describes the allowed links between the warehouses and shipping ports in the real world. Furthermore, the *ProductsPerPlant* table lists all supported warehouse-product combinations. The *VmiCustomers* contains all edge cases, where the warehouse is only allowed to support specific customer, while any other non-listed warehouse can supply any customer. Moreover, the *WhCapacities* lists warehouse capacities measured in the number of orders per day and the *WhCosts* specifies the cost associated in storing the products in a given warehouse measured in dollars per unit.

## **2. Task**

Categorize the problem in the field of SCM. Denote similar problems and formulate the transportation planning problem outlined in the article as a mathematical optimization problem. Visualize the demand data in a suitable way. Find a solution to the outlined problem, calculate the objective value, and display the solution.