

Analytics and Optimization

Case Study 2023

The wholesale company KiP¹ owns distribution centers (DC) in six regions of Republic of Serbia: Vojvodina (DCV), Belgrade (DCB), Šumadija (DCS), Western Serbia (DCW), Eastern and Southern Serbia (DCE) and Kosovo and Metohia (DCK) as depicted in Sheet *Map* of the file *Data.xlsx*. Coordinates of DCs locations as well as their month capacities (number of pallets per month) are given in Sheet *Regions* of the same file. Each DC supplies the retailers located in its region. Retailers and their associated DC suppliers are given in the sheet *Retailers* (the background colors match the colors on the map). The towing capacity of vehicles used for transportation is 10 pallets, consequently the products should be transported from DC to some retailers several times a month.

The analysis of retailer's sales quantities showed that the demand for the company's products has increased, and the capacities of some DCs are not sufficient to satisfy the total demand of retailers from their regions. The company's management decides to firstly find a short-term solution to this problem, and later on a long-term one.

A short-term solution should involve the reallocation of retailers to DCs in such a way that DCs and their retailers do not have to belong to the same region. This decision allows DCs from one region to supply retailers from other regions. The coordinates and demands of the retailers are also given in Sheet *Retailers*. According present prices, unit transportation cost is 0.8 € per kilometer. Distances between locations can be approximated by l_p metric where $p = 1.66$.

A long-term solution should involve renting new DCs. The company's management is negotiating with DC owners on 10 possible locations. For each location, the following data is available: the location coordinates, the DC capacity, and the monthly rental price (see Sheet *Locations*). The estimation is that the cost of transportation will increase up to 1.25 € per kilometer in the following three years.

The number and locations of the new DCs must be decided based on the predicted demand of the retail stores over the next three years. Total retailers demands per region (in pallets) from January 2011 to October 2023 are given in Sheet *Demand*. The management assumes that the demand pattern of the retail stores within one region is the same. Therefore, when the demand is predicted at the regional level, the predicted pattern is applied to each retailer from that region.

Analyst's task is to

- propose a short-term solution for Company KiP;
- propose a long-term solution for Company KiP considering data history;
- write a report for the company's management presenting and analyzing his/her short- and long-term solution proposal from financial point of view;
- provide the following supplementary files: the .xlsx file containing the results of both descriptive and predictive analysis; and the .mod, .dat, and .run files which derive the prescriptive analytics solutions, e.g. decisions that are recommended for short- and long-term period.

1 KiP - "Knowledge is Power"