Master thesis on worker shift model optimization at Picnic Technologies

Location: Düsseldorf

Picnic Technologies is an online supermarket, which was founded in the Netherlands in 2015 and expanded to Germany in 2018. By now, Picnic operates one distribution centre and seven fulfilment centres, and delivers to customers out of 40 hubs in the Netherlands and 15 hubs in Germany.

Over the course of 2020, general interest in Picnic's service has steeply increased and customer demand has skyrocketed, pushing our fulfilment capacity utilisation to a max. While we are speeding up efforts to open new fulfilment centres, significant focus rest upon the optimisation of the utilisation of the existing ones. One potential area of optimisation is the workforce planning in general and more specifically the shift planning. Currently, we work in three shifts. However, on peak days certain shifts cannot grow further due to building constraints such as picking circuit length or storage room.

The main goal of this master thesis is to develop a shift model which enables maximum output of a fulfilment centre while minimising the number of workers required. To this end, in a first step a structured overview of the fulfilment flow when the centre is at maximum capacity needs to be developed. This overview should also feature the requirements which the fulfilment process needs to adhere to such as the timely receiving of inbound or the timely departures of trucks to hubs. Based on this, the fulfilment process should be translated into a mixed integer program in Python. The objective of this program is to determine a shift model (featuring number of shifts offered, shift start times and shift lengths) which allows to produce the maximum number of deliveries that can be fulfilled in a day while minimising the workforce required.

To ensure usability, uncertainties underlying factors such as inbound deviations from forecasts, worker absence rates, worker experience or picker blocking should be considered.

If you want to find out more about Picnic, check out https://medium.com/lifes-a-picnic and https://blog.picnic.nl/.