#### CoEnzyme Analytics & Decision Optimization

# **Optimization in ports**

Bernd Dittrich, Unsplash

# **Berth assignment**

Alex Duffy, Unsplash



# **Berth** assignment

The problem has been well solved since the 2000s

- Shipping companies make "calls" (request services) with
  - Time window
  - Ship characteristics
- Ports assign them to berths taking into account
  - Physical limitations
    - Ship length
    - Depth of segments of berth
    - Number of available cranes
    - Reach and height of cranes
  - Possible delays



## **Berth assignment : solutions**



Typical solutions to the berth allocation problem include

- Space between ships
- Assignment of cranes to ships
- Temporal leeway between ships to manage delays



## **Berth assignment : delays**



Solutions are computed taking into account potential **delays and domino effects they cause**. Leeway is added to stop the "propagation" of delays.

In this example if ship 1 is a little delayed, the domino effect stops at ship 5.



#### **Berth assignment : cranes**



Solutions also consider the **assignment of cranes to ships**, and the fact that cranes need to be moved along the quay, cranes cannot cross. etc.

Chuttersnap, Unsplash





In the port of Maasvlakte (Rotterdam) inter terminal transfers can be made by truck or train.

Despite short distances, because there is a very large amount of containers to move between terminals, there are long queues and **containers may wait a long time before being transferred**.





Distances are small and point to point transfer times are quite short in theory...





But the volume of containers that can be moved is small due to ports layout which results in **limited throughput** 

Jerome Monta, Unsplash



Berthing needs to be done with a overall view that **minimizes the number of inter terminal transfers** of containers.

It is similar to airports where you want to limit inter terminal transfers of passengers as monorails have limited capacity



# Yard organization

Chuttersnap, Unsplash

# Ca.

# Yard organization



The movement of containers within the yard needs to be
efficient for ships to stay at quay as little as possible.

Faster unloading and loading means more capacity to service more ships and better customer service.

# Co.

# Yard organization

Studies have shown the unloading time is more or less proportional to the number of containers, the distance to the storage point and the number of cranes at work.



# Yard organization



Berthing needs to take into account the **location of the storage and the flow of containers** in and out, to minimize the time spent at quay





# Yard organization

Also needs to be considered the **capacity of yards** and the fact that piling containers on top of each other slows downs the loading and unloading as yard cranes need to move many containers before getting access to the one they want to send to the ship





Analytics & Decision Optimization