

Case Study: Maximizing Push Boat Fleet's Net Voyage Revenue

Problem:

InterBarge, a first-class waterway operator, affiliated with SCF Marine, a part of Seacor Holding Group, operates freight along the HPP Waterway (Hidrovia Parana Paraguay, located in Argentina, Paraguay, Brazil, and Uruguay) on a dedicated contract carriage. Both push boats and barges are preassigned to these contracts. During certain seasons of the year, these resources are free of contract commitment and/or have free convoy capacity on certain trips.

The company's challenge was to use this free capacity as a fleet, maximizing net voyage revenue, and deliver the dedicated contract freights by choosing the best convoy sizes and vessel allocation.

The managers questioned how to schedule all of their operations through this new fleeting mode, where there is complete independence between push boats, barges, and nondedicated contracts, while including the dedicated contracts in the system. They wanted to analyze the behavior of the system where each push boat would decide, in an intelligent way, when arriving at a port or fleeting point, which is the best route to follow, and which barges they can use to build up temporary convoys.

Ite Consult found simulation modeling to be the best tool to provide InterBarge with the answers to these questions. The goals of the simulation project were:

To maximize net voyage revenue of the company vehicles and resources through a planning tool (deciding which trips to do, which contracts to commit, where to allocate push boats and barges, and more).

- To evaluate the risk of new push boats' and barges' acquisition.
- To create a tool to identify revenues and negotiate contract freight price.
- To create a tool to plan all operations on a short and long term basis.

Solution:

The model was designed with AnyLogic, using both discrete event and agent based methodologies. Push boats and barges navigate along the rivers, stop in each node or port, and then decide if they should use it as a point to start a nondedicated contract carriage. Push boats or barges make decisions according to their geographical location at the moment the decision has to be made. The model calculates Time Charter Equivalent for each active/available contract and recommends the best convoy configuration, taking into account all potential parameters and constraints.

The input data included:

- Available waterway demand and seasonality (contracts, products, prices, fees, and more).
- Fleet of push boats and barges (resource type, intake, speed, draft, power, bunker consumption, maintenance requirements, and more).
- Rivers and ports specifications (water levels, loading and unloading capabilities, rates for each product, and more).
- Distance between ports and destination points.
- Operation costs and timings of fleet usage and ports' operations.

Model constraints and parameters included:

- Restricted routes/nodes for push boats due to rivers' water level or flag restrictions.
- Push boats' pulling capacity when navigating upstream or downstream.
- Push boats' speed when navigating upstream or downstream, loaded or unloaded.
- Bunker consumption.

- Contracts' weekly offers and seasonality.
- Preassigned fleet.
- Barges' intake by barge type, products' cubic factor, and water level by month.
- Loading and unloading times.

Outcome:

The model simulates a 5-year period in less than 300 seconds, while considering nearly 250 external variables and multiple scenario options. This decision-support system allows users to easily identify the expected net voyage revenue for given resources and waterway freight transportation demand, and creates recommendations on which strategy to choose.

Users are provided with a group of key indicators such as tons delivered per contract, navigating times and costs, barge and push boat usage and locations, mooring and waiting times in each port, bunker consumption, etc. This information enables managers to make the best decision among those provided by the system. It also allows them to plan routes for push boats and convoys on a short or long term basis.

The output data is exported in Excel files in order to make additional reporting or analysis convenient. It is also possible to integrate the model with databases in the company's existing IT infrastructure.

The resulting simulation model utilizes user-driven inputs and scenarios, and can be easily adapted to changes and/or new requirements.

More info can be found at developers' presentation on [YouTube](#).