Supply Chain Network Optimization

Simulation, Vehicle Routing Optimization, Simulated Annealing

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Goldratt Research Labs

Our vision: Helping organizations and individuals make better faster decisions… when it really matters

We are passionate about helping organizations answer two simple but important questions:

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1. Company and Project background

The Company

- One of the **largest distributors** in their industry around the world
- **Substantial growth in number depot locations** resulted in complex and costly delivery model
- **Uncertainty** and **volatility** in future **demand** will lead to over- and underutilized warehouse space
- Current network design unsustainable due to
  - **Increased** real estate **costs** in a number of current depot locations
  - Higley **competitive driver market** with high driver turnover rates

Previous Studies

- Two other consultancies conducted a **high-level network optimization study** concluded that
  - Depot locations could be reduced by 25%-30%
  - This requires the use of **Drop-and-Hook method** and **40-foot trailers**.
  - Total NPV of the project calculated at **$18M**

2. Project and Model Objectives

Project Objectives

- **Confirm** the expected **operational and financial impact** and validate the assumptions and results from previous optimization project
- **Investigate** and **evaluate alternative** supply chain configurations and fleet setups.

Model Objectives

- Build a **self-configurable model** that can consider **critical system interdependencies, constraints, complexities and variability.**
- Model must be able to simulate supply chain configuration based on
  - Customer and depot **locations**
  - Fleet **size** and management **rules** and driving **restrictions**
- The model needs to be able to:
  - **Optimize** customer to depot allocations
  - **Generate routes** using Vehicle Routing Heuristics
  - Quantify the likely **Operational and Financial** impact

3. Why Simulation, Why Anylogic ?

Why Simulation?

- Can consider all the **critical system interdependencies, constraints, complexities and variability**
- Can provide a **range of likely outcomes** for single scenarios, do sensitivity analysis and direct scenario comparisons
- Can provide a **low-risk, low-cost** way to test the impact of any changes on both operational and financial performance

Why AnyLogic?

- Can replicate **the real-world complexity** through the use of both **Agent-based** and **Discrete Event** simulation methods
- Ability to create **Self-Configurable** models to cut dev time, ensure usability and scalability for a range of system configurations
- Ability to export the model as a **stand-alone app** and option to use **AnyLogic Cloud** to run resource-intensive models
- Able to **utilize standard Java** libraries and integrate with numerous other applications (e.g Route Optimization Software)

Model setup

Inputs

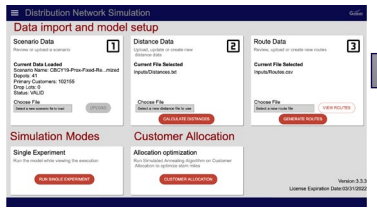
- Network configuration
- Demand data
- Financials
- Fleet configuration
- Other parameters

- Pre-calculated routes
- Distance matrix

Excel

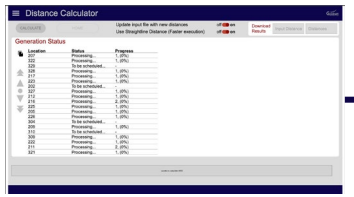
TXT

AnyLogic Model

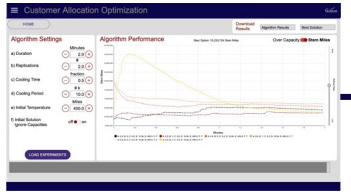


Analysis Options

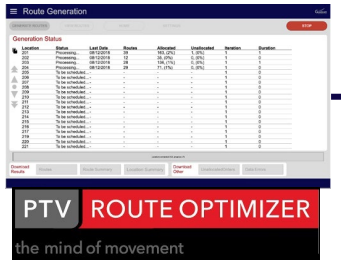
Distance Calculator



Allocation Optimizer



Route Scheduler



Scenario Analysis

Output

Distance matrix — TXT

Customer Depot Allocation — TXT

Routes & Summary Reports — TXT

Model reports

Logs — TXT

Model Demo

Results

- Model proved that the number of depots could be reduced
- Model highlighted flawed assumptions in the previous study
  - The drop-and-hook method is not as cost effective as initially thought
  - The number of line hauls were significantly higher
- Previous NPV of $18M recalculated to -$5M
- The team identified a new optimized network structure with an NPV of $47M.
- The model was able to provide much more detail in terms of:
  - Class of driver required, per month, per location
  - Number of vehicles (trucks and trailers) required per day
  - Number of overnight routes, driver hours and overtime
- Model is now used on a regular basis to check assumptions and guide strategic decision making while the network optimization continues

Questions and Answers

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