Optimization of IKEA Fleet Size and Inventory

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Overview

- **IKEA**
  - Large furniture franchise
  - Stores in 37 countries
  - 23 stores in US
  - 2 major distribution centers in US

- **US Business Plan**
  - Add 10 stores in 10 years
  - Locations of 4 stores over next 2 years are known

Project Scope

- 1 Distribution Center
  - Elizabeth, NJ
  - Currently supplies 9 IKEA stores
    - Current Range
      - New Haven, CT to Woodbridge, VA
  - Addition of 2 stores over next 2 years
    - Projected Range
      - Stoughton, MA to Atlanta, GA

Objectives

- Determine current fleet size required to meet demand at current stores

- Determine projected fleet size required to meet demand at projected stores

- Determine shipping patterns required to minimize backorders while maintaining current fleet size

Data Collection

Name	Distance (miles)	Time (hours)
Baltimore, MD	163.9	9.5
College Park, MD	205.5	10.9
Conshohocken, PA	85.4	6.8
Long Island, NY	44.4	5.5
New Haven, CT	94.2	7.1
Paramus, NJ	25.8	4.9
Philadelphia, PA	87.0	6.9
Pittsburgh, PA	373.7	16.5
Woodbridge, VA	246.3	12.2
Atlanta, GA	870.9	33.0
Stoughton, MA	232.5	11.8

#	Name	Average Weekly Sales ($)	% of CP Share (%)
1	Baltimore	723435	0.51
2	College Park	1416900	1.00
3	Conshohocken	855169	0.60
4	Elizabeth	2288023	1.61
5	Long Island	1668408	1.18
6	New Haven	1479180	1.04
7	Paramus	1352761	0.95
8	Philadelphia	596127	0.42
9	Pittsburgh	545633	0.39
10	Woodbridge	1165350	0.82
11	Atlanta	1209099	0.85
12	Stoughton	1209099	0.85

Data Collection

- 39 products
- Data collected April 15 (Week 15)
- Avg. sales/week =

    total sales year to date/15
- Apply sales ratios

Product Number	Average Per Week	Baltimore	College Park	Conshohocken	Long Island	New Haven	Paramus	Philadelphia	Pittsburgh	Woodbridge	Atlanta	Stoughton
		51.1%	100.0%	60.4%	117.8%	104.4%	95.5%	42.1%	38.5%	82.2%	85.0%	85.0%
1	602.7	308	603	364	710	630	576	254	233	496	513	513

Simulation 1

- **Goal**: Determine current fleet size required to meet or exceed demand at current stores

- **Constraints**: Supply >= Demand (no backorders)

- **Input**: Pallet capacity, weekly sales, delivery hours

Simulation 2

- **Goal:** Determine projected fleet size required to meet or exceed demand at projected stores

- **Constraints:** Supply >= Demand (no backorders)

- **Input:** Pallet capacity, weekly sales, delivery hours

Results

- **Simulation 1:**
  - Minimum required fleet size = 2 trucks/week

- **Simulation 2:**
  - Minimum required fleet size = 3 trucks/week

- **Implications:**
  - Sample size = 39, Population size > 14,000
  - Addition of over 350 trucks

Optimization

- Scope
  - Limited to one week
    - Use average inventory over year
  - Limited to one store at a time
    - Pre-allocate trucks based on share of sales

Optimization

- **Objective function**: Minimize backorders
- **Constraints**: Pallets shipped = Pallets allocated, integer
- **Input**: Average inventory, weekly demand, pallet capacity, allocated truck trips

Results

Store Number	Store Name	Total Backorders	% Backordered
1	Baltimore	5	0.25
2	College Park	280	7.17
3	Conshohocken	58	2.45
4	Long Island	262	5.70
5	New Haven	345	8.46
6	Paramus	229	6.14
7	Philadelphia	58	3.51
8	Pittsburgh	100	6.60
9	Woodbridge	157	4.89
10	Atlanta	140	4.22
11	Stoughton	88	2.65
Total		1722	
Average		156.545455	4.73

Results

- If current fleet is not expanded, 5 of 11 stores do not meet 95% of the demand.

- May be unacceptable in maintaining customer satisfaction

Recommendations

- Based on meeting 95% of demand, we would recommend expanding the fleet used to ship these 39 products by one truck.

- An optimal decision cannot be made without a cost-benefit analysis