Why \((Q,r)\) Model?

- Stochastic demand ~ ND
- Stochastic lead time
- Continuous Review
- Finding order quantity \(Q\), and reorder point \(R\) for each product

Initial Observations

Demand has a high variance

- Number of devices produced changes day to day for each device
- Demand spikes at the end of each quarter (seasonality)

Variance between devices

- Amount of floor space occupied by material not proportional to demand

State of System

- 5 products w/ unique inventory turns
- 32+ Pallets using valuable floor space
- Signaling system consists of
  - Waterline/Visual approximation
  - Refill inventory by carrying back and forth

Constraints/Requirements

Constraints

- 5-foot vertical stacking rule
- Supplier capabilities
- No changes to package design or production schedule

Requirements

- Maintain 100% uptime
- Easy to manage
- Deliver solution by June 2020

Goal Statement

Provide Stryker solutions to reduce packaging footprint by >25% while maintain 100% uptime by June 2020.

Deliverables Include:

- Simulation Model – used to define reorder point and quantity
- Right Size Inventory Levels – reduce holding costs, must withstand demand shocks and variation to maintain 100% uptime
- Inventory Cart – Decrease handling time, move inventory faster and ergonomically

Accomplishments

- Projected floor space reduction - by 50%
- Reduction of Operating Costs – approx. $50,000/year
- QR and Simio Models – quantity & number of carts
- Create SolidWorks models - for all devices
- Reduce Muda - Remove the use of pallets to reduce transportation by material handlers

ISE Methodologies

Sensitivity Analysis

- Sensitivity Analysis on simulation model to find where the system is most vulnerable to failures

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Physical Cart Prototype

- Created physical cart prototype for 1 lines of devices
- To validate design
- Used PVC pipes and Stryker packaging materials

COVID-19 Changes

- Overall direction and goals remain the same
- Adapted to accomplishing goals remotely
- Shifted to modeling approach

Cart Design

- Solidworks to design
- Red zone is Kanban signal
- Casters for easy transportation
- High durability
- Easy to assemble

Problem Statement

Stryker has packaging footprint of ~500 sq ft. This space is needed for building products, not holding inventory.

Background

Stryker is one of the world’s leading medical technology companies. They offer innovative products and services that help improve patient and hospital outcomes.

Demand Probability Distribution Fitting

Histirical Data

- Historical Data
- MLE Distribution Fitting
- Device 1’s demand follows Normal Distribution \((\mu, \sigma)\)
- Why \((Q,r)\) Model?

Simulation Model

- Tracks inventory and service levels over time to determine amount of carts needed in Kanban system
- OptQuest to test different reorder points and validate QR model

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