

Modeling Regulatory Impacts on Medical Device Supply Chains

Agenda

Issue

History

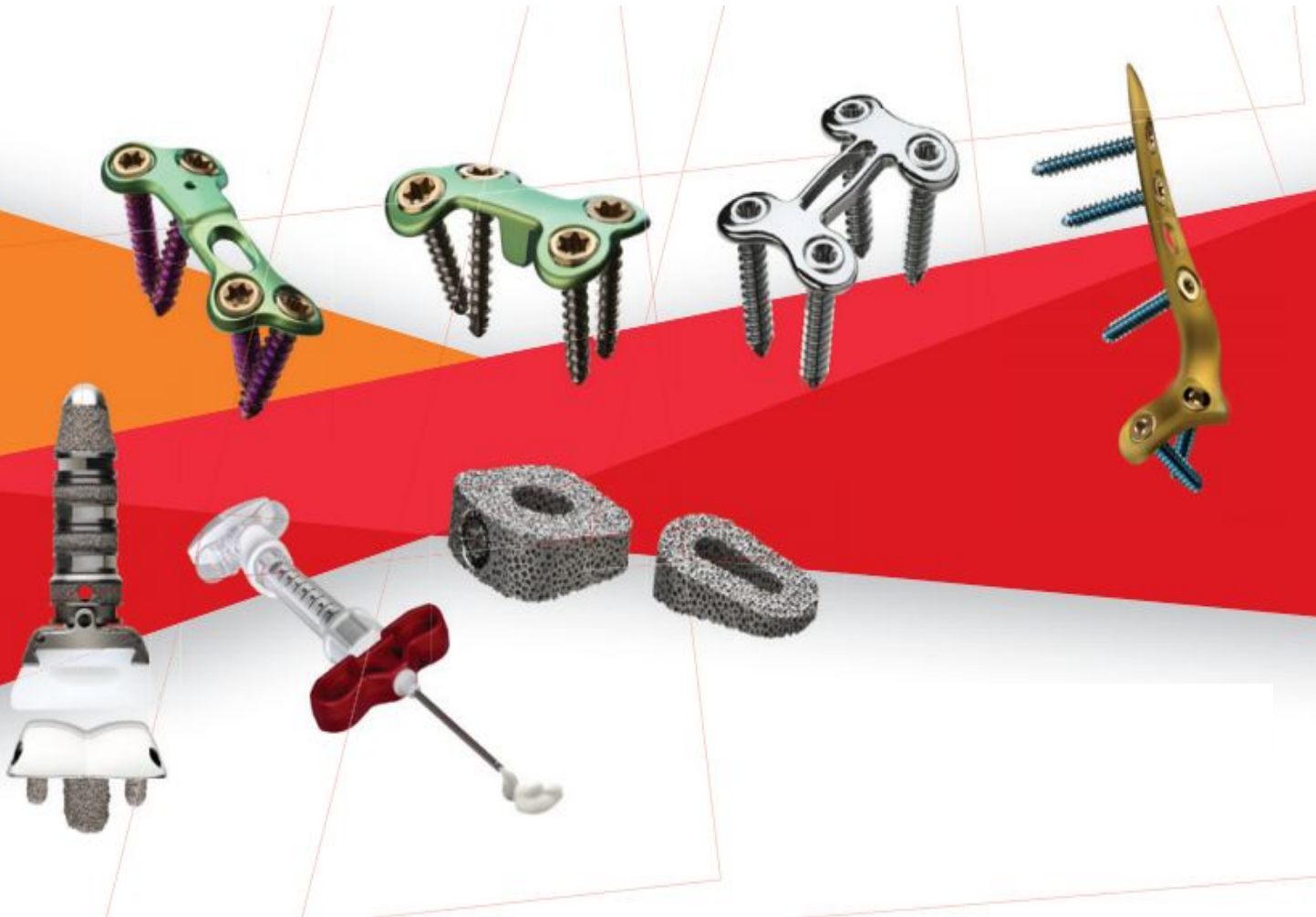
Industry

Analytics

Model

Application

Results



“Ensures patient safety & efficacy”

Medical Device-

Any equipment used to treat, diagnose or prevent disease

Regulated by complexity and degree of risk

Supply Chain Implications

- Traceability
- High Quality/Sanitary
- Origin & Sourcing
- Packaging & Labeling

1906
Start of Food and Drug legislation

1917
Fraudulent devices flood the market- Nose straighteners, Height stretching machines

1926
Problem exacerbates- radium belts to cure gall bladders

1936
Congress Modernizes the act

1976
Authority to preapprove devices before going to market



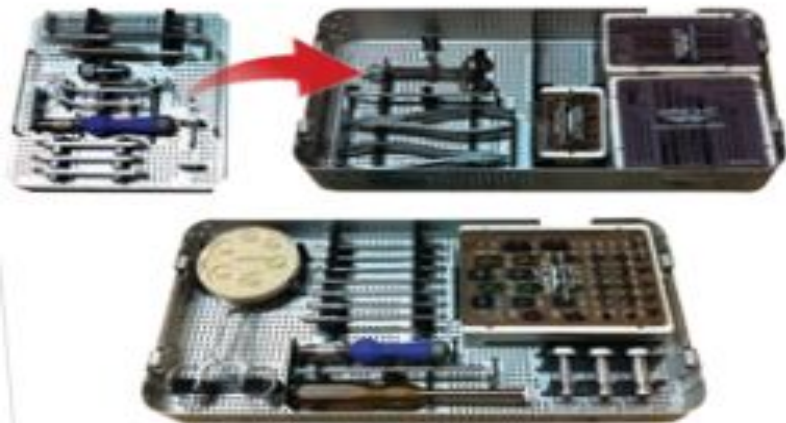
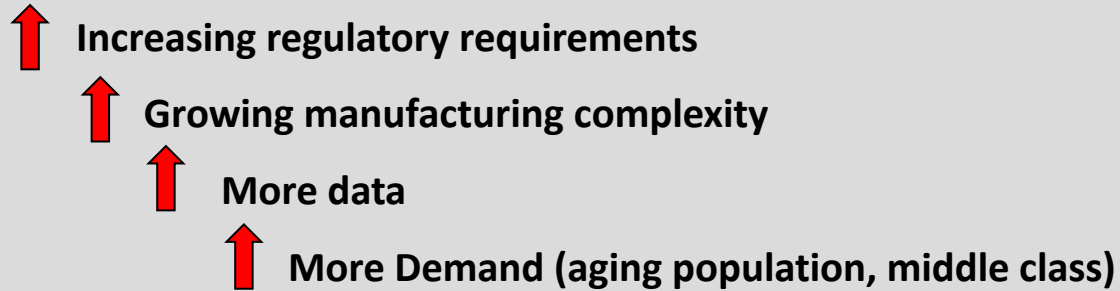
ARTHROPLASTY

ORIF

ANCILLARIES

Industry

\$522 Billion dollar industry



HOSPITAL GROUPS & HMO

- Lower Cost
- Less Inventory
- Value Added Services & Bundling

INNOVATION

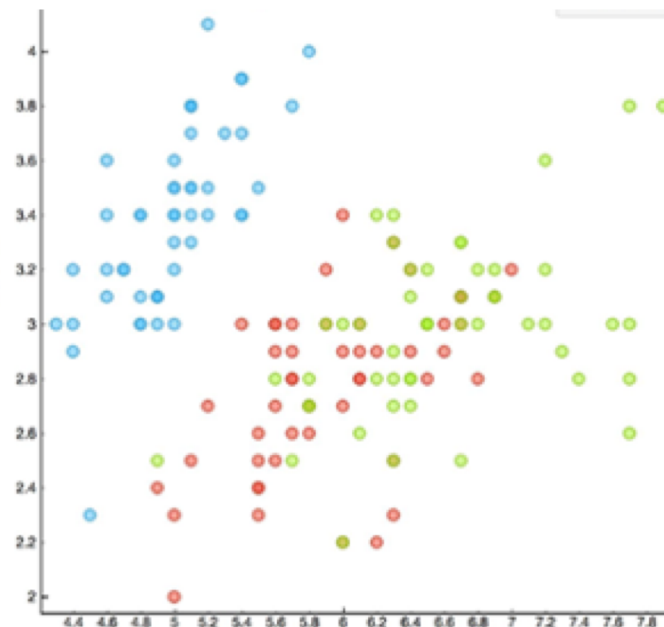
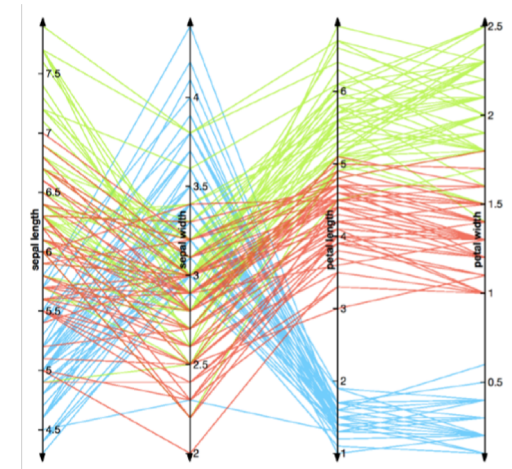
- Advancements in Technology
- Med Device Mergers & Acquisitions
- Life Cycle Management & Commoditization

Leveraging statistical algorithms to...

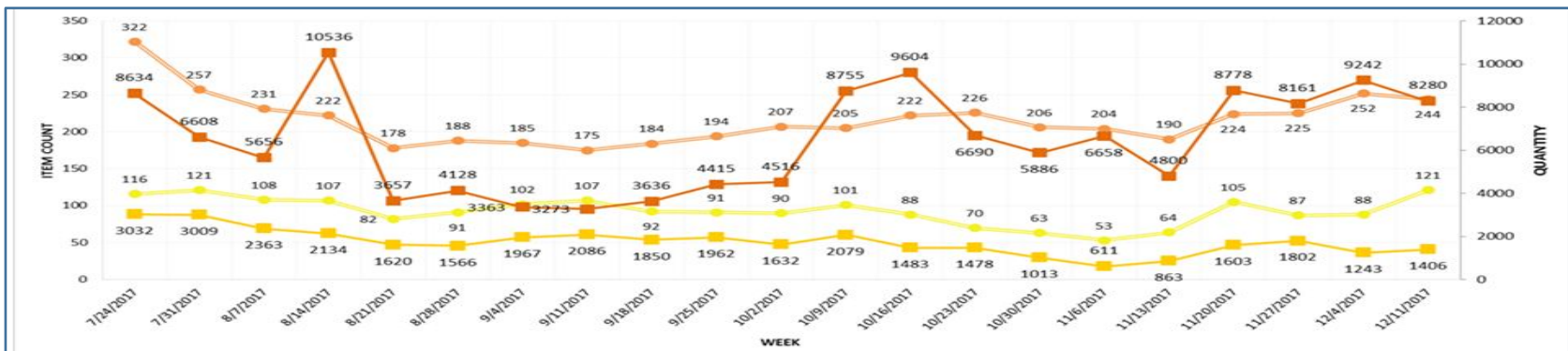
- Identify subtle patterns
- Find relationships between variables
- Model and predict unknown impacts

Key Attributes:

- Makes vs Buy
- Avg Leadtimes
- Forecast Variability
- Safety Stock & Inventory
- History of Backorders
- Works Order & Purchase Order Performance
- Item Classification
- Country or plant location
- Order / MFG frequency



Methodology



Linear Regression-

Looks at a set of 'n' variables, predicts a specific, continuous outcome

$$y = c + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n$$

Where:

y = predicted dependent variable

c = a constant

β_n = regression coefficient of independent variable x_n

x_n = independent variable n

Logistic Regression-

Looks at a set of 'n' variables, predicts a binary outcome of class

$$\text{logit}(p) = c + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n$$

Where:

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right)$$

p = probability of an event occurring in twelve months

c = a constant

β_n = regression coefficient of independent variable x_n

x_n = independent variable n

1. Linear Regression

$$y = c + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n$$

Where:

y = predicted dependent variable

c = a constant

β_n = regression coefficient of independent variable x_n

x_n = independent variable n

$$R^2 = 22\%$$

Next steps...

- Gather more data
- Conduct PCA

1. Logistic Regression

$$\text{logit}(p) = c + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n$$

Where:

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right)$$

p = probability of an event occurring in twelve months

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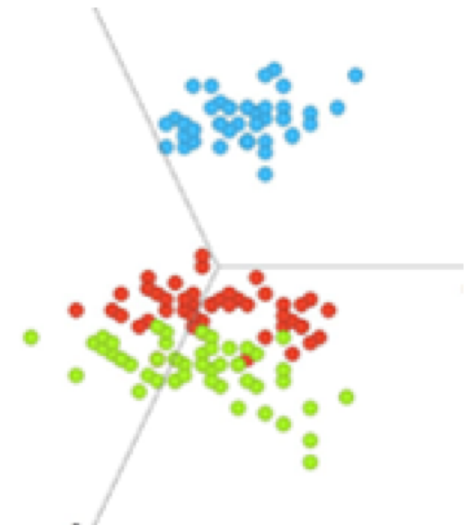
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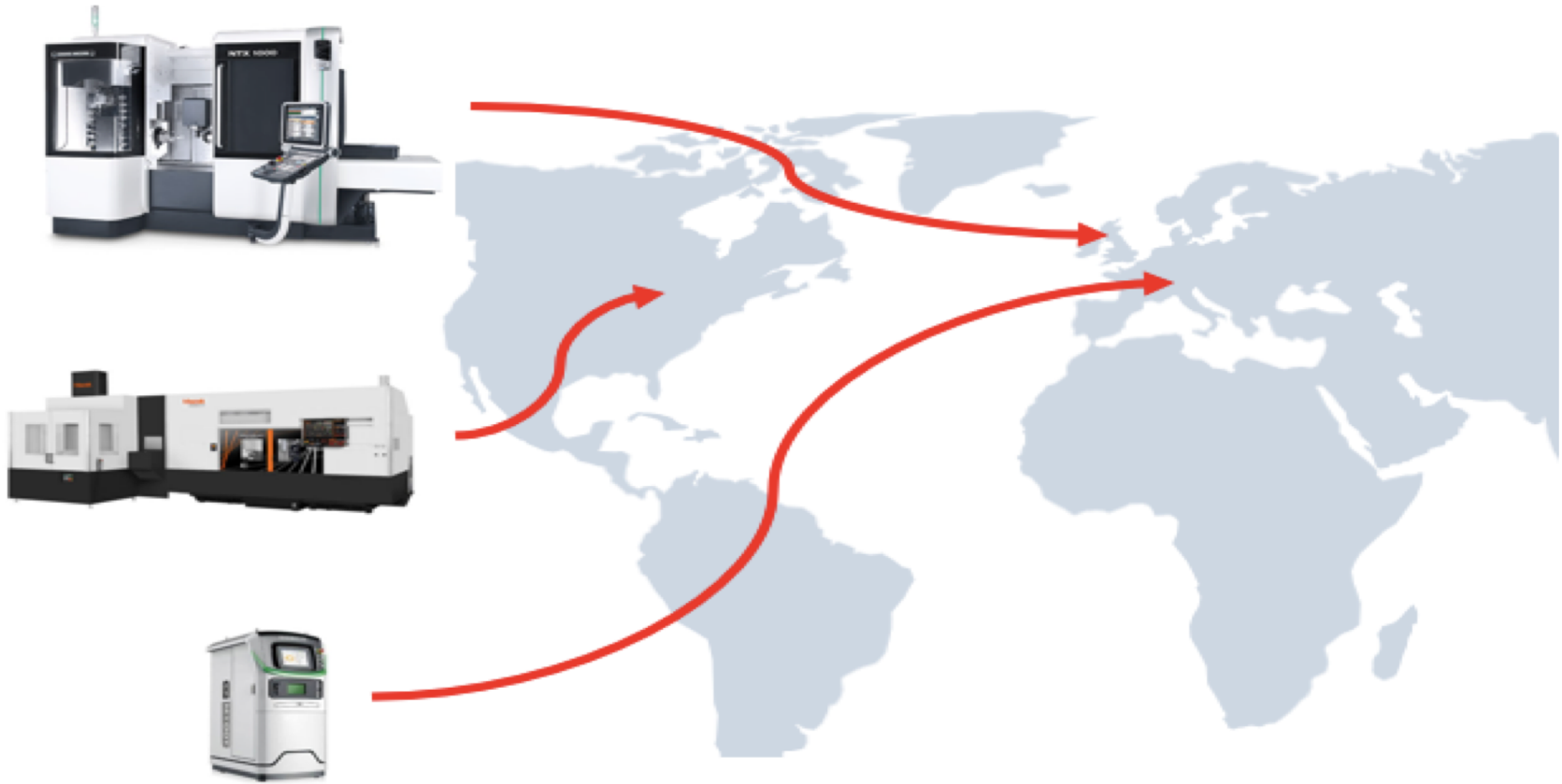
$$R^2 = 78\%$$

Next steps...

- Gather more data
- Conduct PCA



Application



Current State:

74% probability that there will be instances of backorders

Application

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Option 1: Ireland
62%

Option 2: USA
77%

Option 3: France
76%

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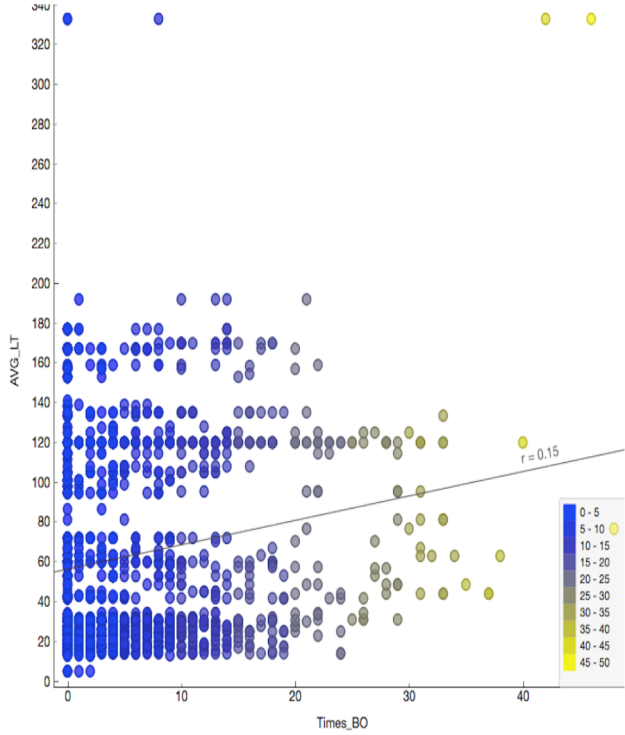
Learnings & Next Steps

CHALLENGES:

- 1. Data Quality & Availability are Key
- 2. Law of Diminishing Returns
- 3. System Maturity & Integration

OPPORTUNITIES:

- 1. Relationships between independent variables
- 2. System Maturity & Integration = BETTER RESULTS
- 3. Predictive Analytics SME



Questions?