Optimal Operating Strategies for a Segmented Supply Chain

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MIT Supply Chain
MANAGEMENT

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Project Background & Scope

- Company:

  a multi-national manufacturer and distributor of a range of fast moving consumer goods
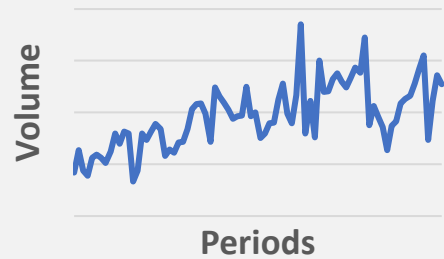

Supplier → Manufacturer → Distribution Center → Retailer → Customer

- Order fulfillment:

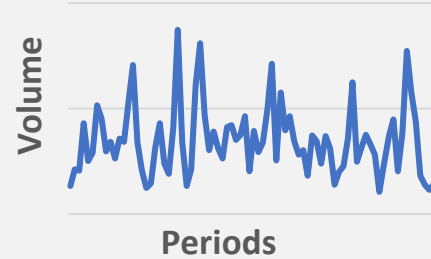 Based on demand signal from customers which is broken down into 4 unique replenishment streams
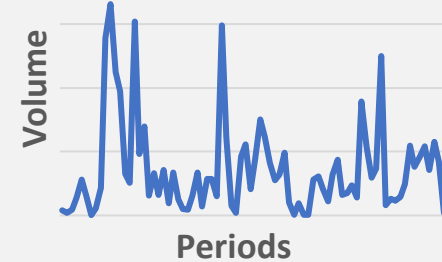
Replenishment Streams

Base Demand

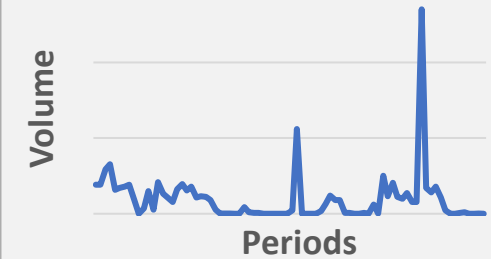❖ Daily movement of product characterized by stable demand signal

Promotions

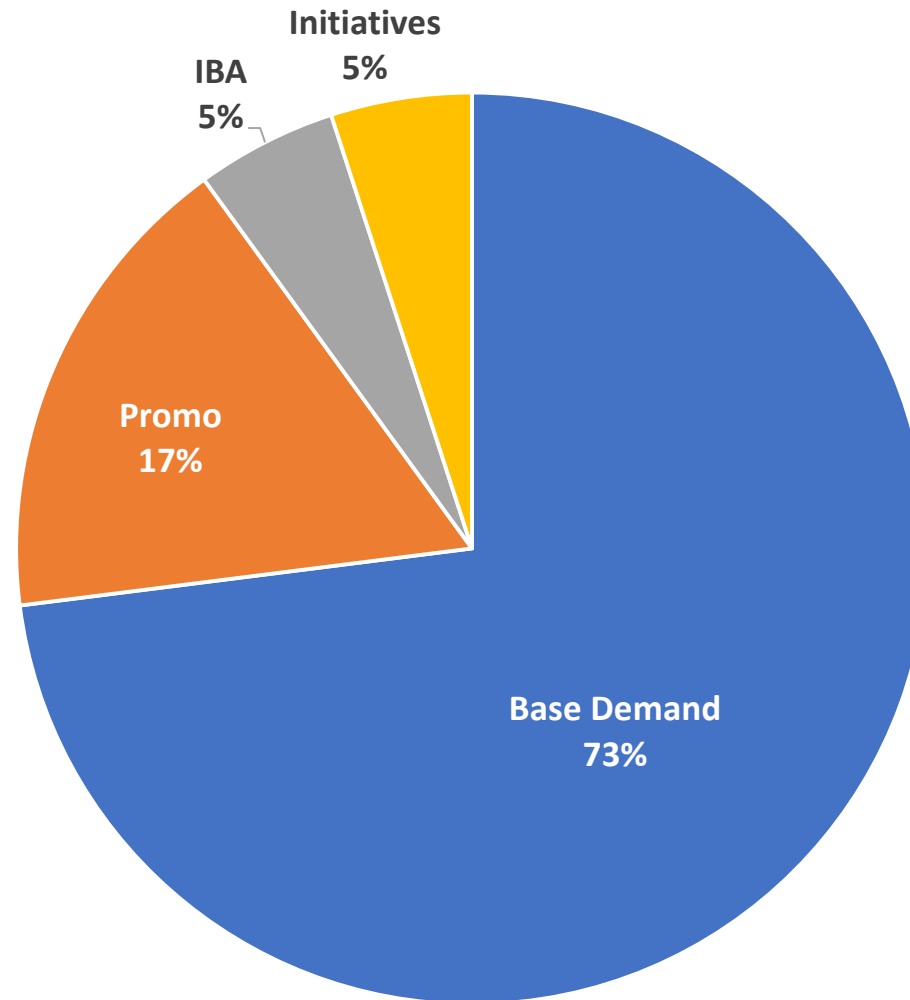❖ Planned promotional activities such as ads in retail stores

IBA

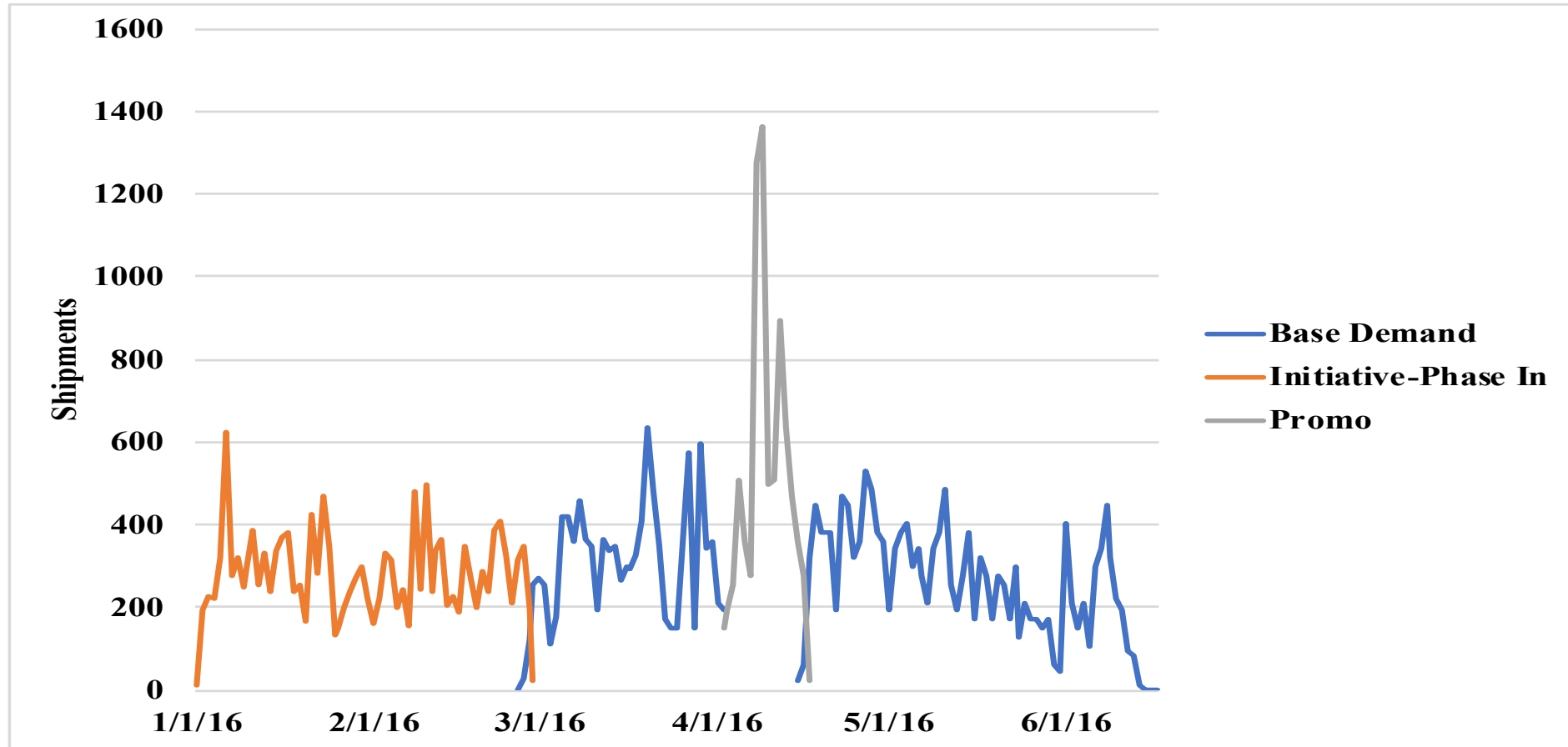❖ Unplanned demand spikes that occur with very little notice

Initiatives

❖ Driven primarily by customer launch plans

❖ New SKUs brought to market for the first time

4

% Shipment Volume by Streams

SKU Behavior

Note: Replenishment streams are not a property of the SKU

Research Questions

Is there a benefit to differentiating the supply chain by the four identified replenishment streams or some hybrid?

What are the optimal supply chain operating strategies for **demand**, **sourcing**, and **distribution** that minimize cost, increase cash, and maximize service and sales?

Data

- 10,000 rows of shipment data over a span of 19 months

- 7 brands of a product family filtered to 3 pertinent brands

- 835 distinct SKUs

- Geolocation mapping of company's manufacturing plants and mixing centers

Data Analysis

- Segmentation

- Coefficient of Variation

- Time Series Analysis and Forecasting

- Mean Absolute Percent Error (MAPE)

- Distribution Network Mapping

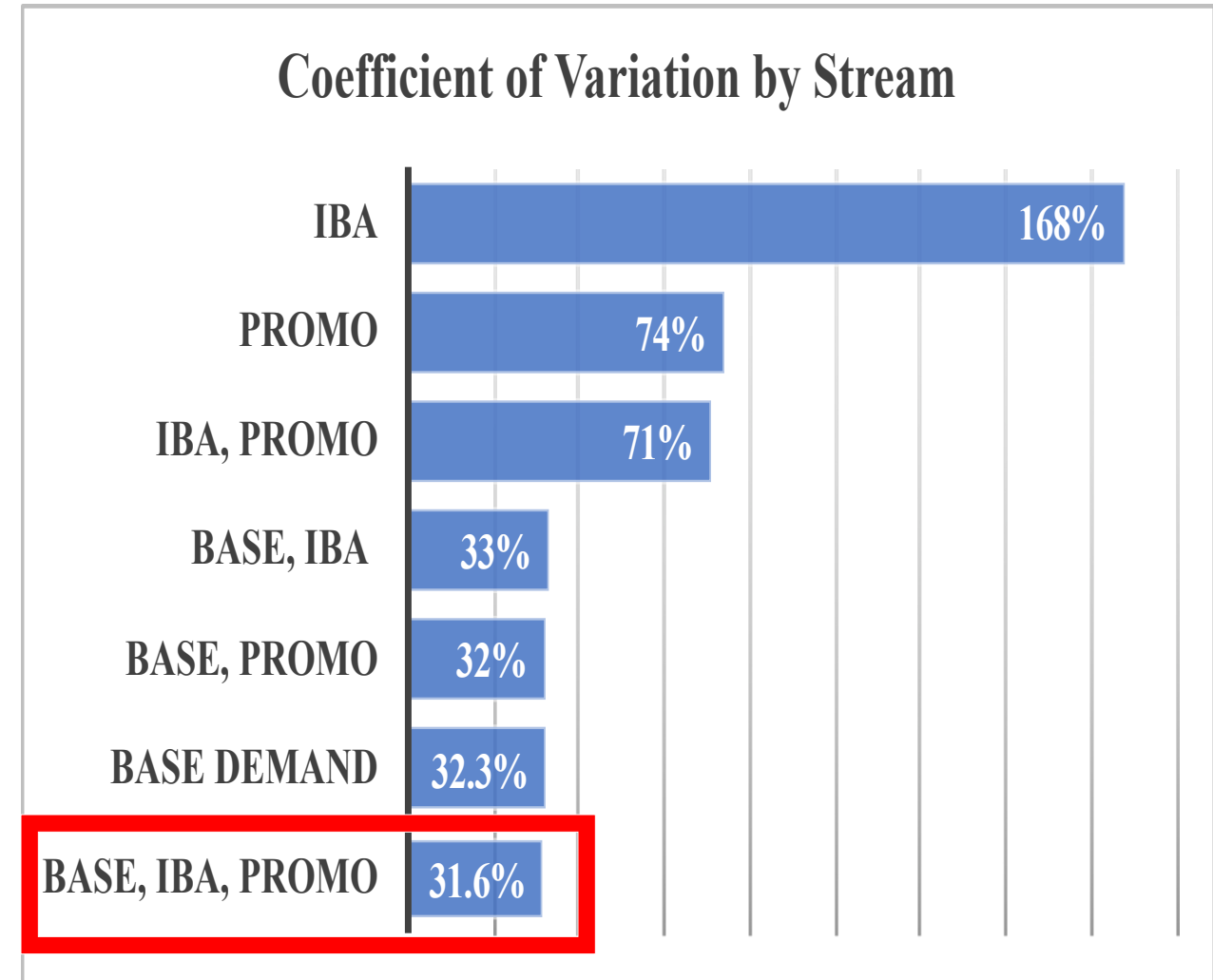- Case Fill Rate

Demand Strategy

Demand Strategy

Hypothesis:

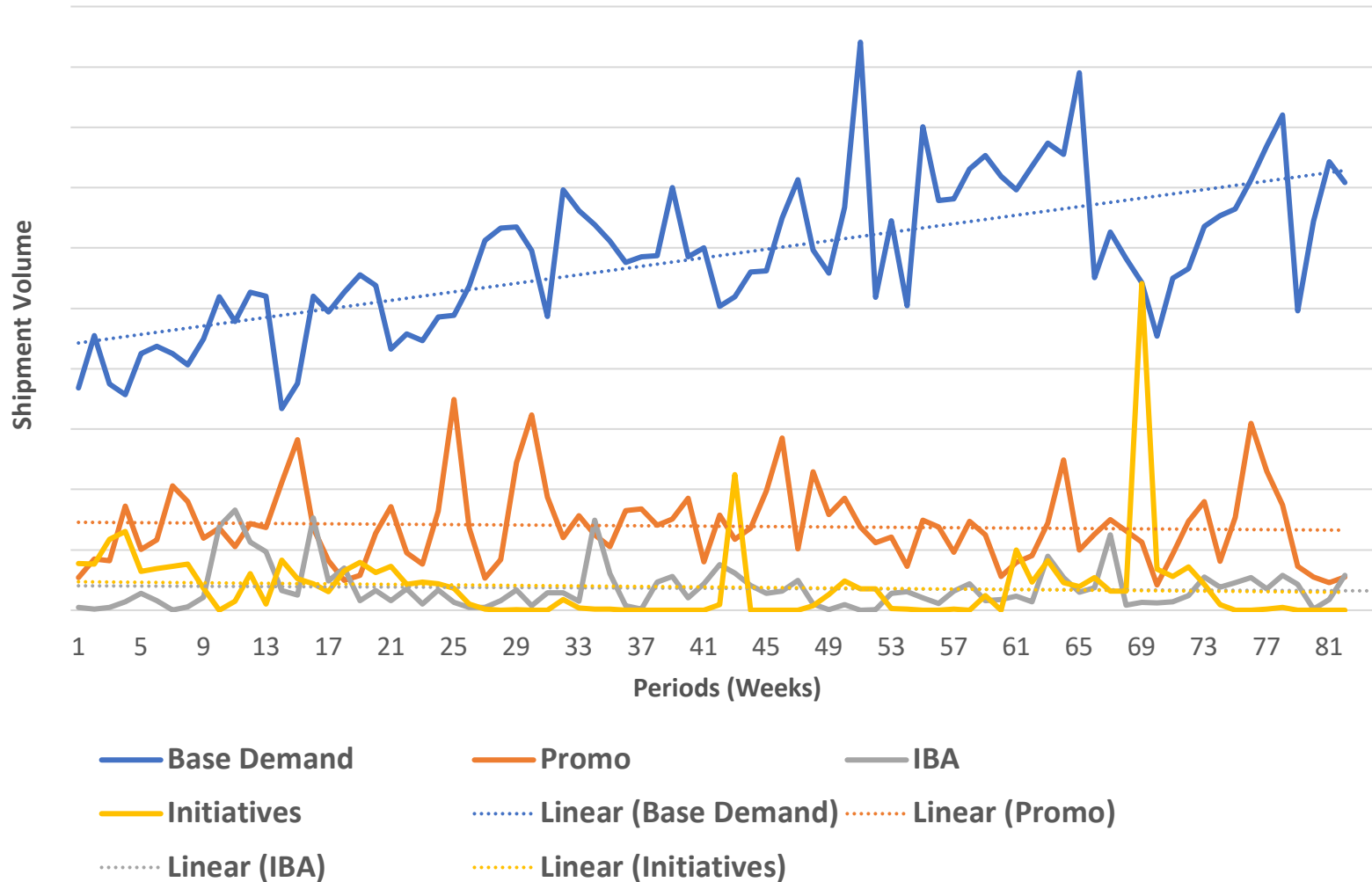| Pool Streams	→	Decreased Variability	→	**Higher Forecast Accuracy**	→	Reduction of Safety Stock	→	Lower Average Inventory

Demand Strategy

❖ Coefficient of Variation used to measure variability

❖ New Initiatives stream was not included as production plan is dependent on customer launch plans
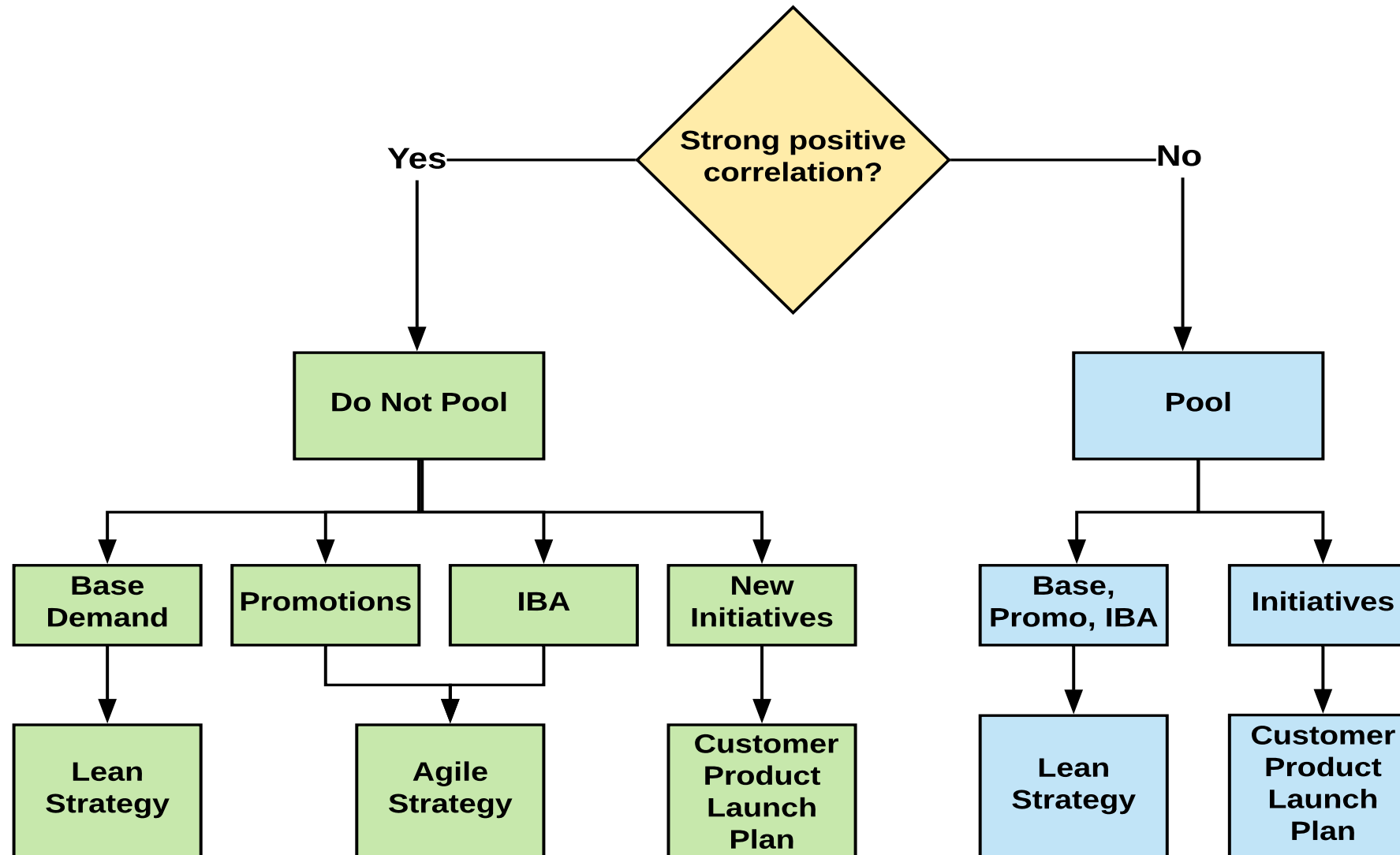
Coefficient of Variation by Stream

Stream	Value
IBA	168%
PROMO	74%
IBA, PROMO	71%
BASE, IBA	33%
BASE, PROMO	32%
BASE DEMAND	32.3%
BASE, IBA, PROMO	31.6%

Demand Strategy

Shipments by Stream and Week

Stream	MAPE	CoV
IBA	256%	168%
Promo	33%	74%
Base Demand	9%	32.3%
Base Demand, IBA, Promo	9%	31.6%

Legend: Base Demand — Promo — IBA — Initiatives — Linear (Base Demand) ⋯ Linear (Promo) ⋯ Linear (IBA) ⋯ Linear (Initiatives)

Demand Strategy

Demand Strategy

| Base Demand	Promotions	IBA	Base, Promo, IBA
LEAN STRATEGY	**AGILE STRATEGY**	**AGILE STRATEGY**	**LEAN STRATEGY** <u>Pooling Benefits</u>
○ Stable demand ○ Eliminate non-value adding activities	○ Collaborative Planning, Forecasting & Replenishment (CPFR)	○ Collaborative Planning, Forecasting & Replenishment	○ Improved forecast accuracy ○ Lower safety stock leading to lower average inventory ○ Streamline Operations

Distribution Strategy

Distribution Strategy

4 Distinct Strategies:

❖ Direct Shipment
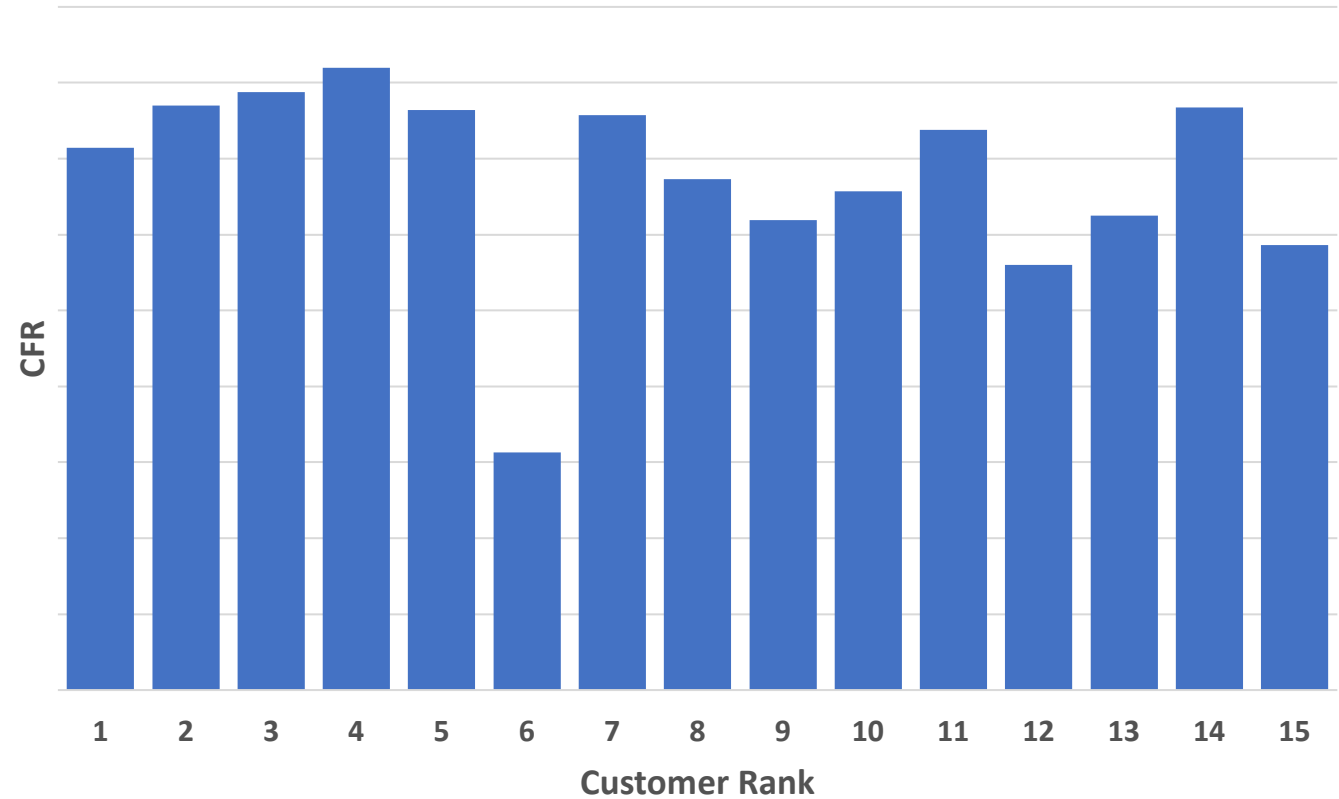
❖ Warehousing

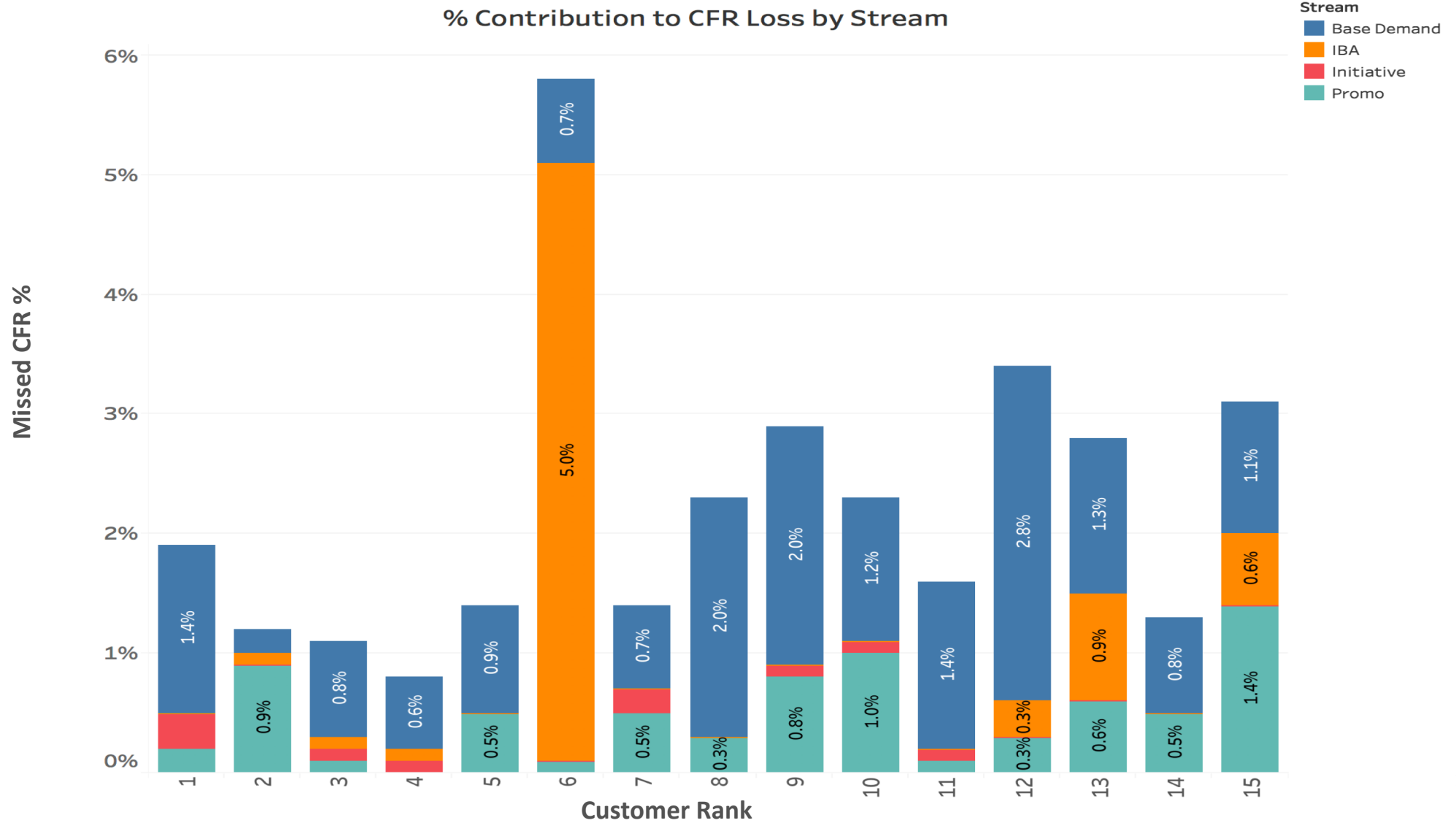❖ Cross Docking

❖ Transshipment
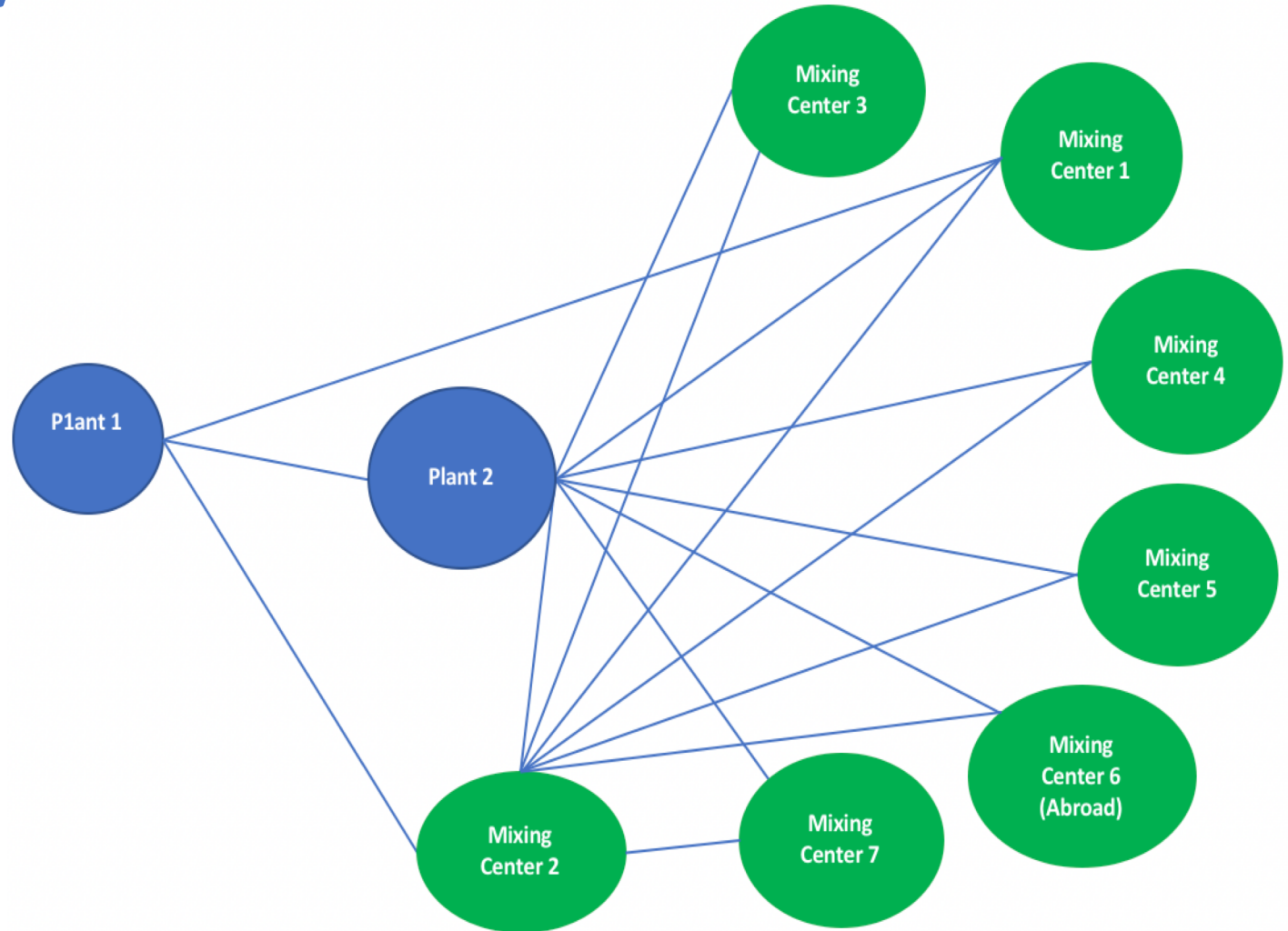
Distribution Strategy

Case Fill Rate (CFR):

❖ Measure of Customer Service level and the satisfaction of customers

❖ Amount shipped over amount ordered

CFR for Top 15 Customers

Customer Rank

18

Distribution Strategy

% Contribution to CFR Loss by Stream

Distribution Strategy

Lean	Agile	"Leagile"

Base Demand

- o Focused on elimination of waste and non value adding activities

New Initiatives

- o Flexibility

Promo & IBA

- o Lean & Agile hybrid that employs postponement

Distribution Strategy

Base Demand

❖ Top 15 customers drive ~80% of base demand

❖ The top customer is responsible for ~32% of base demand shipments

❖ Strategically store inventory for the base demand stream in mixing centers that regularly services those particular customers

OPTIMIZE FOR LEAN

Distribution Strategy

New Initiatives

❖ 95% of volume driven by the top 12 customers with customer #1 responsible for 74% of the shipments

❖ 2 options for customer #1:
  - Directly ship products to customer contingent on transportation costs and shipment volume
  - Direct shipment from plant to mixing center and cross docked for shipment to customer

❖ Remaining 26% of shipments are fragmented between customers. Pursue option 2 above

OPTIMIZE FOR AGILITY

Distribution Strategy

Promotions and IBA

❖ Promotions and IBA together only make up 22% of total shipments

❖ Pool both under a **"leagile"** strategy that employs postponement

❖ Generic form of products should be held at mixing centers and customized accordingly when order is received

"Leagile" Distribution Strategy

Decoupling Point

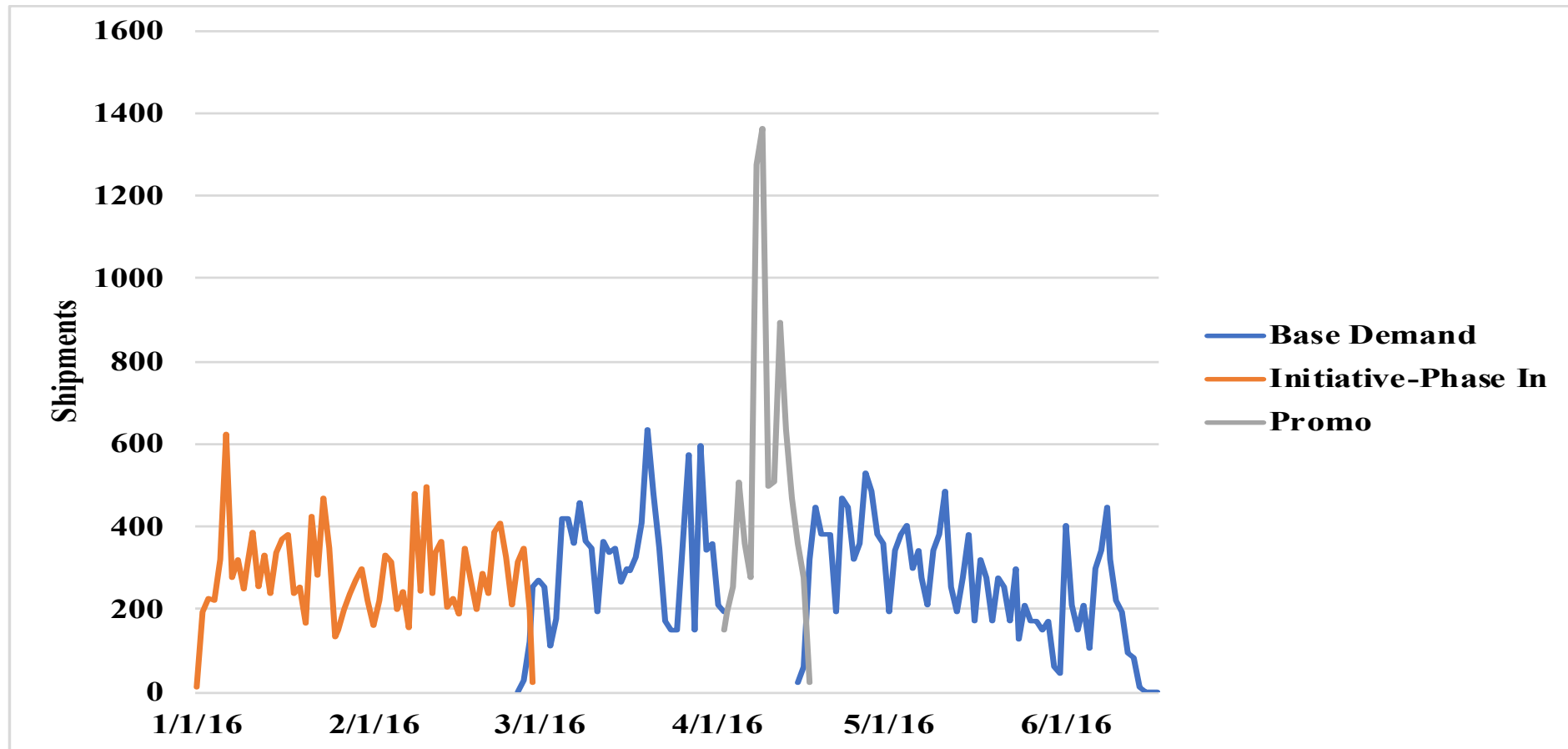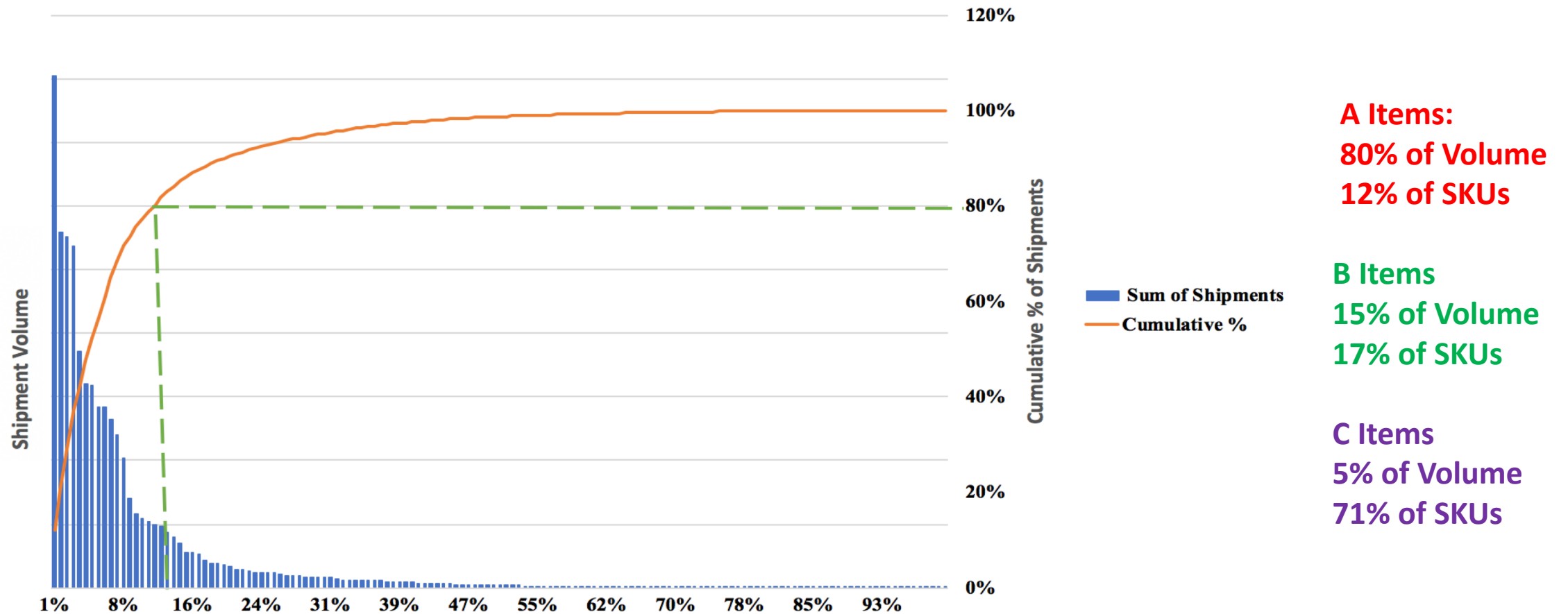Lean Process → Agile Process
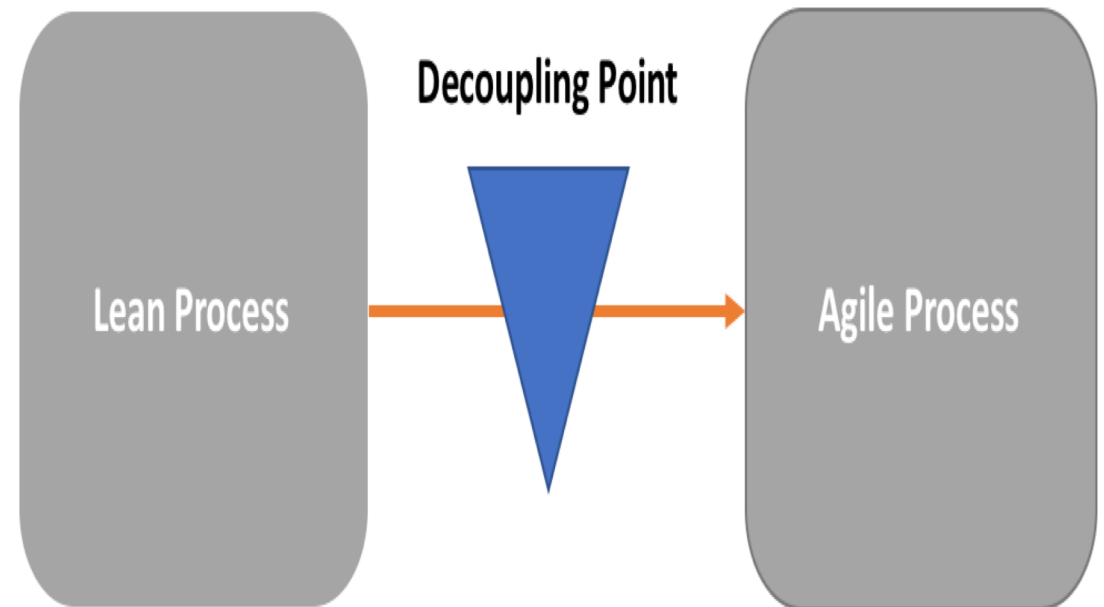
Sourcing Strategy

SKU Behavior

Note: Replenishment streams are not a property of the SKU

SKU Segmentation

SKU Pareto Chart

A Items:
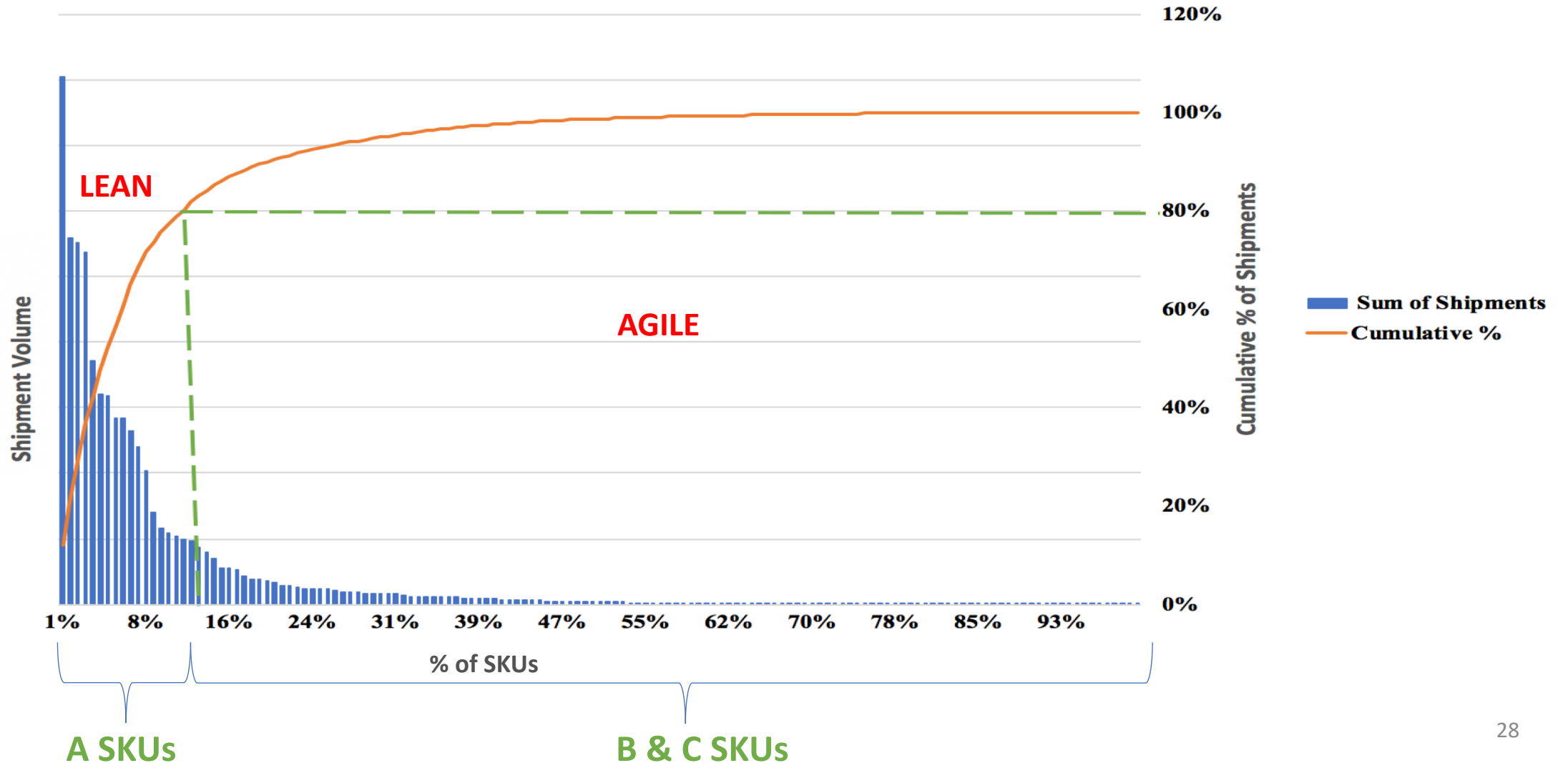80% of Volume
12% of SKUs

B Items
15% of Volume
17% of SKUs

C Items
5% of Volume
71% of SKUs

Sourcing Strategy

SKU Volume and Variability Profile

- ● A SKUs
- ● B & C SKUs

Variability

Weekly Volume (Thousands)
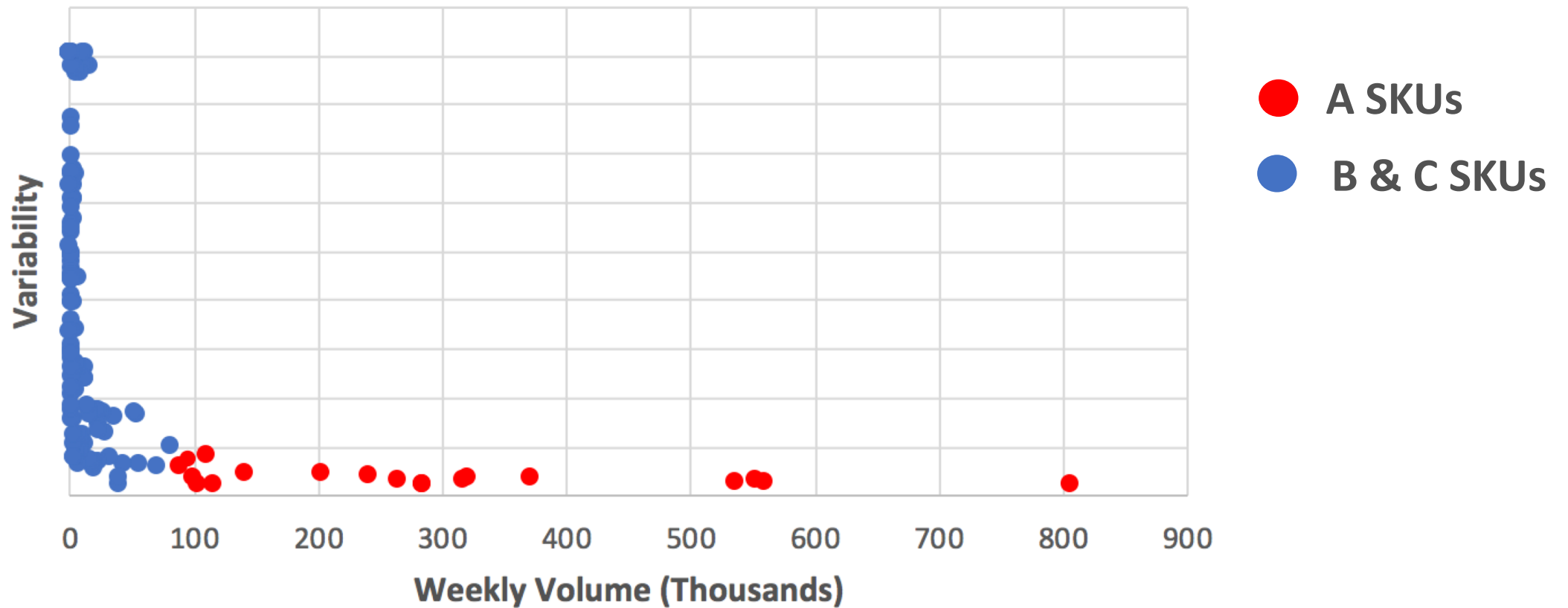
Sourcing Strategy

SKU Pareto Chart

Sourcing Strategy

ALL SKUS

"A" SKUs
(12% of SKUs,
80% of Volume)

"B" SKUs
(17% of SKUs,
15% of Volume)

"C" SKUs
(71% of SKUs,
5% of Volume)

Optimize for Lean
- Long term Strategic
Contract
- Low Cost Sources

Optimize for Agility
- Source Closer to
Market
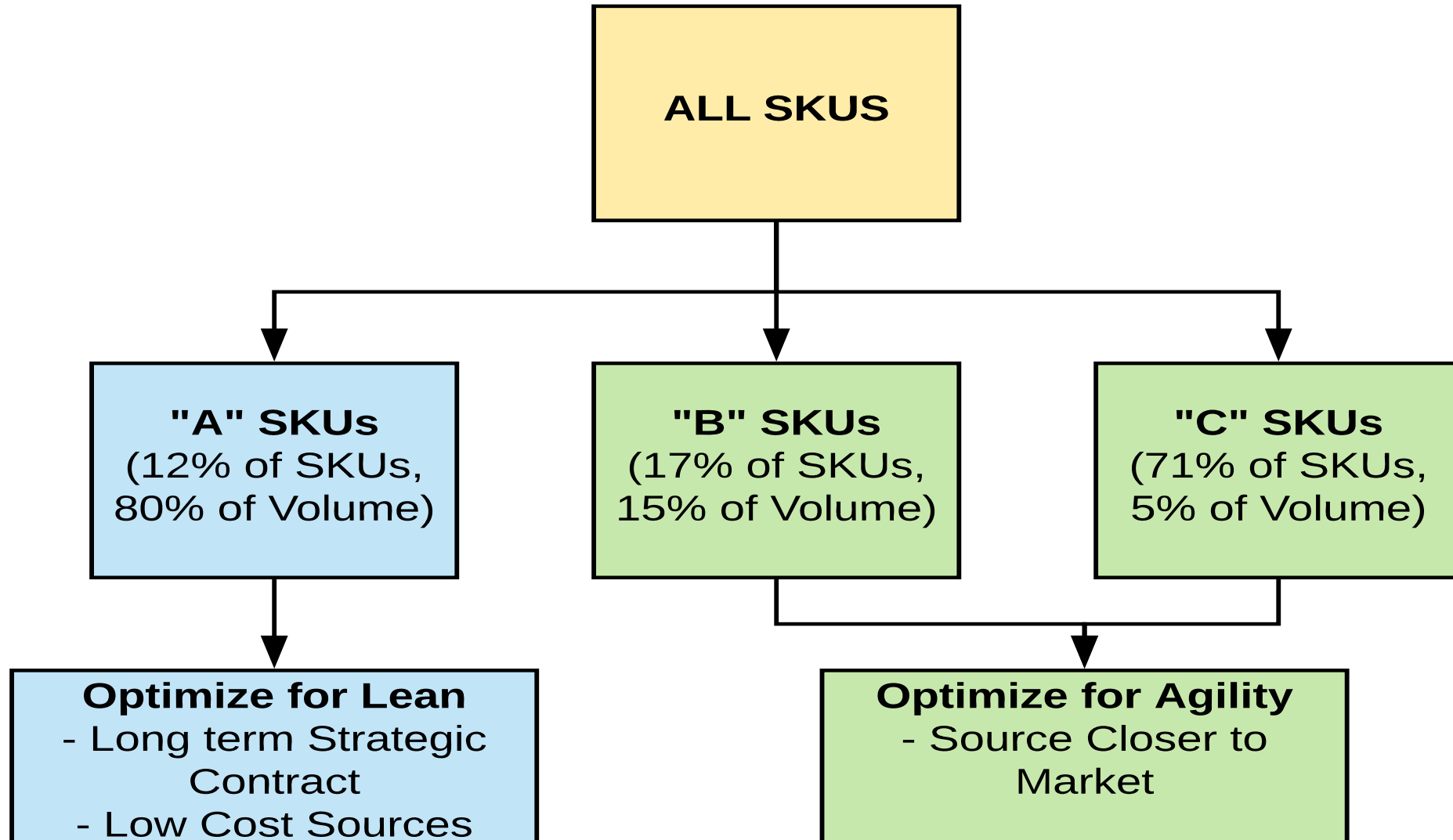
Takeaways

- "One size does not fit all" when it comes to operational strategies.

- Strategies should be curated for a company according to a company's data, resources and capabilities.