Innovation in stock optimization

BECOME AN INDUSTRY LEADER BY REDUCING YOUR INVENTORY WITH 50%

Breda, 18 June 2015

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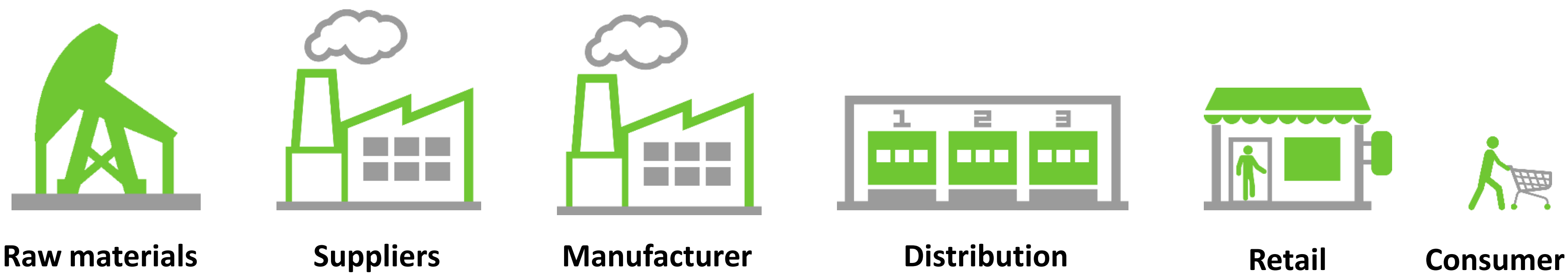
The recommendations, advice and conclusions, mentioned in this report, are based on the information and data provided by client. Savings, operational costs and investment estimates are depending on the assumptions and preconditions stated in this report. All orders are accepted and carried-out according to the Groenewout Terms and Conditions 2012.

WHY INVENTORY?

5 REASONS FOR KEEPING INVENTORY

Supply chain: from raw materials till consumer



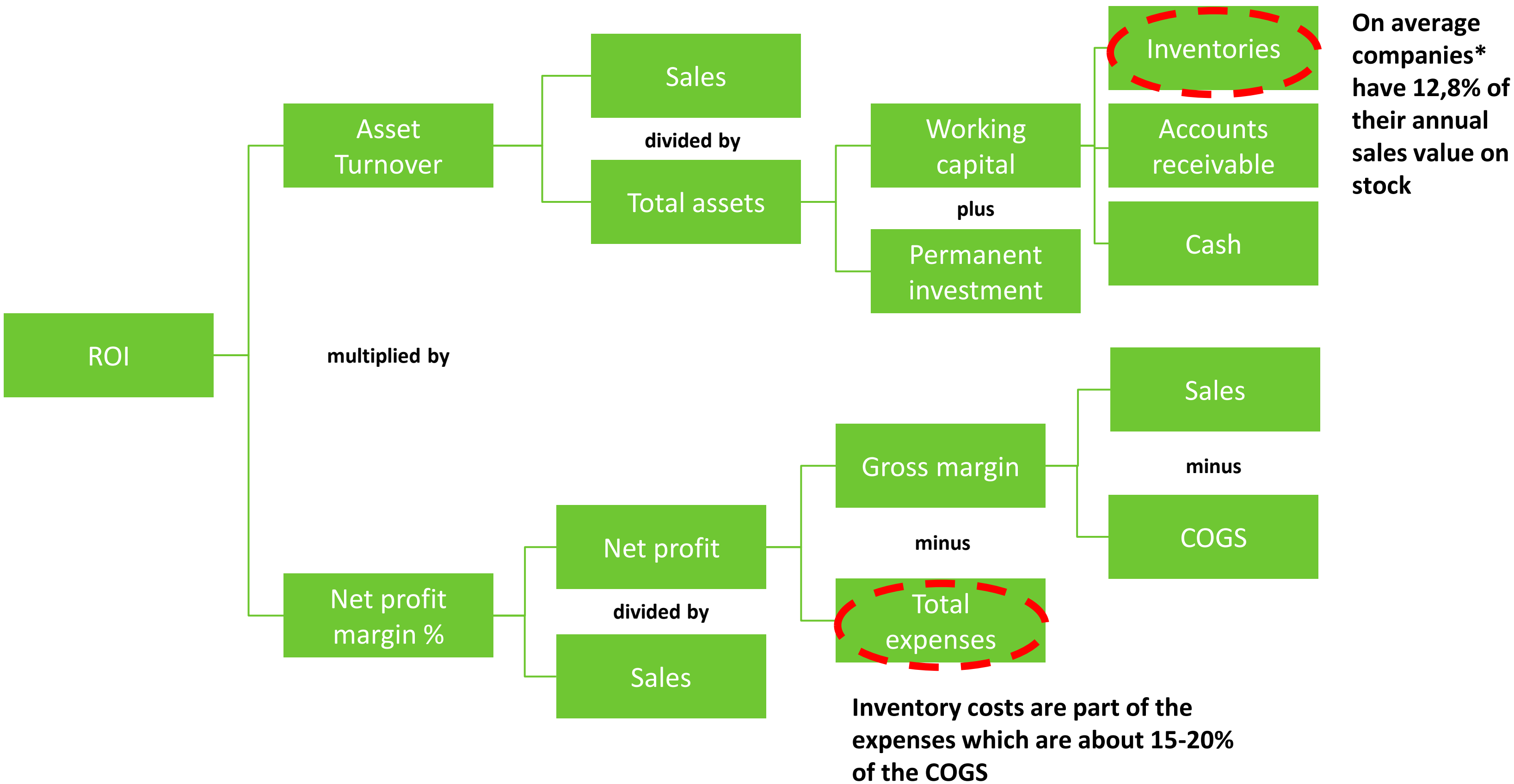
Supply chain: from raw materials till consumer

- **Strategic**: trading & speculation
- **Capacity**: limited capacity requires stockbuild (e.g. seasonality)
- **Order quantity**: economic to order more than 1 pcs.
- **Uncertainty**: demand-, supply quantity and lead times
- **Lead time**: Coverage of lead time demand

The impact of inventory on Return On Investment

INVENTORY IMPACTS THE ASSET TURNOVER AND NET PROFIT MARGIN

DuPont chart: Inventory affects asset efficiency and net profit



Inventory reduction results in an **increase** of **asset turnover** and **net profit margin**. Meaning that the **ROI** is leveraged from both sides. A lean inventory is a key issue to become an **industry leader**.

*source: working capital benchmark PwC July 2014

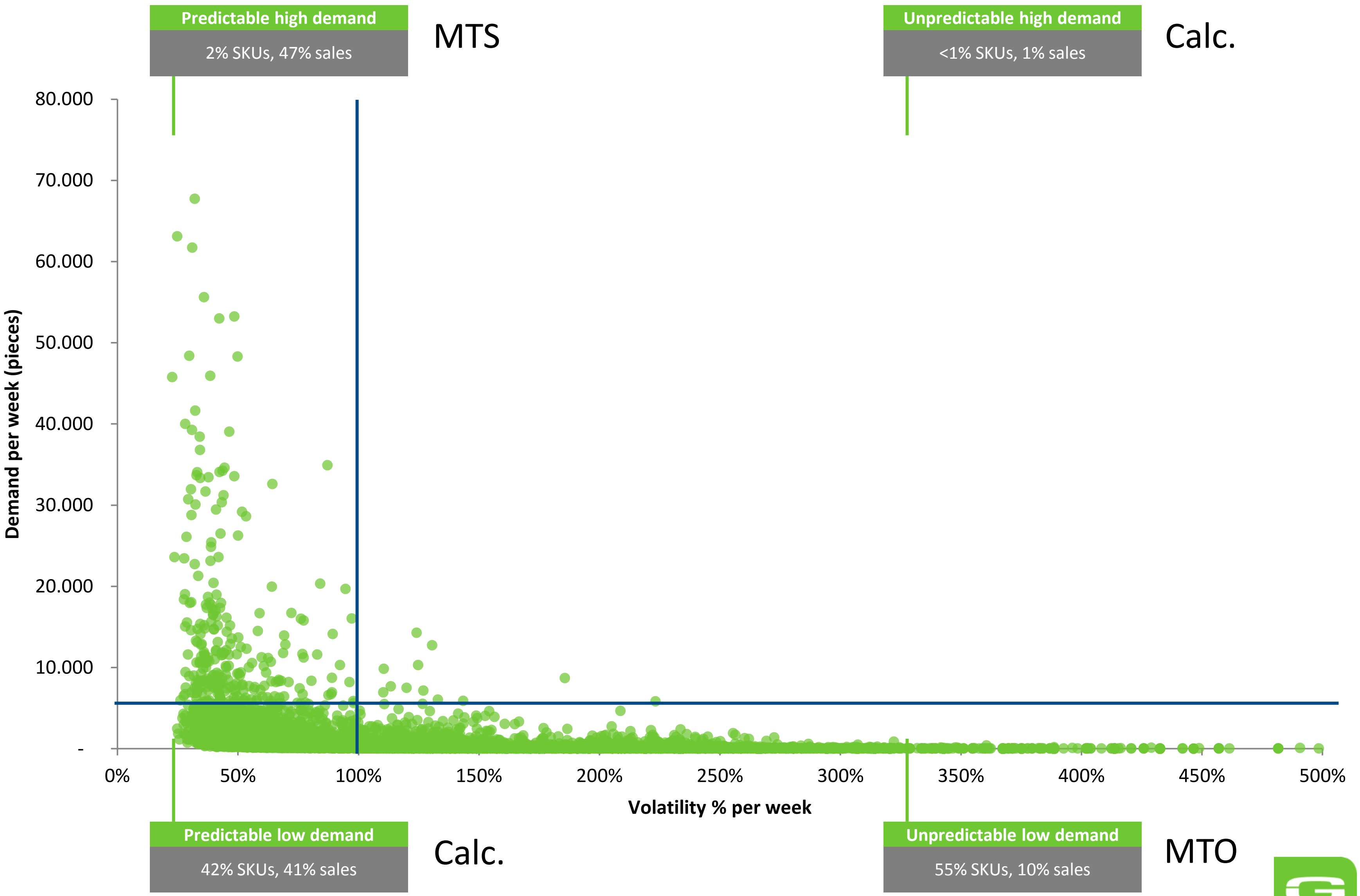
Decision making process portfolio and stock mgmt.

STOCK POLICY DECISIONS AND VARIABLES

	Decisions	Variables
Strategic	Item in portfolio (yes/no)	Customer needs, profitability, supplementary, etc.
Strategic	Make-To-Stock vs. Make-To-Order	Production lead time vs. customer requirements
Strategic	Where to stock (central vs. local)	Customer demand, volatility demand, transport costs
Tactical	Stock Quantity	Supplier lead time, demand characteristics
Tactical	Order Quantity / Safety Stock	

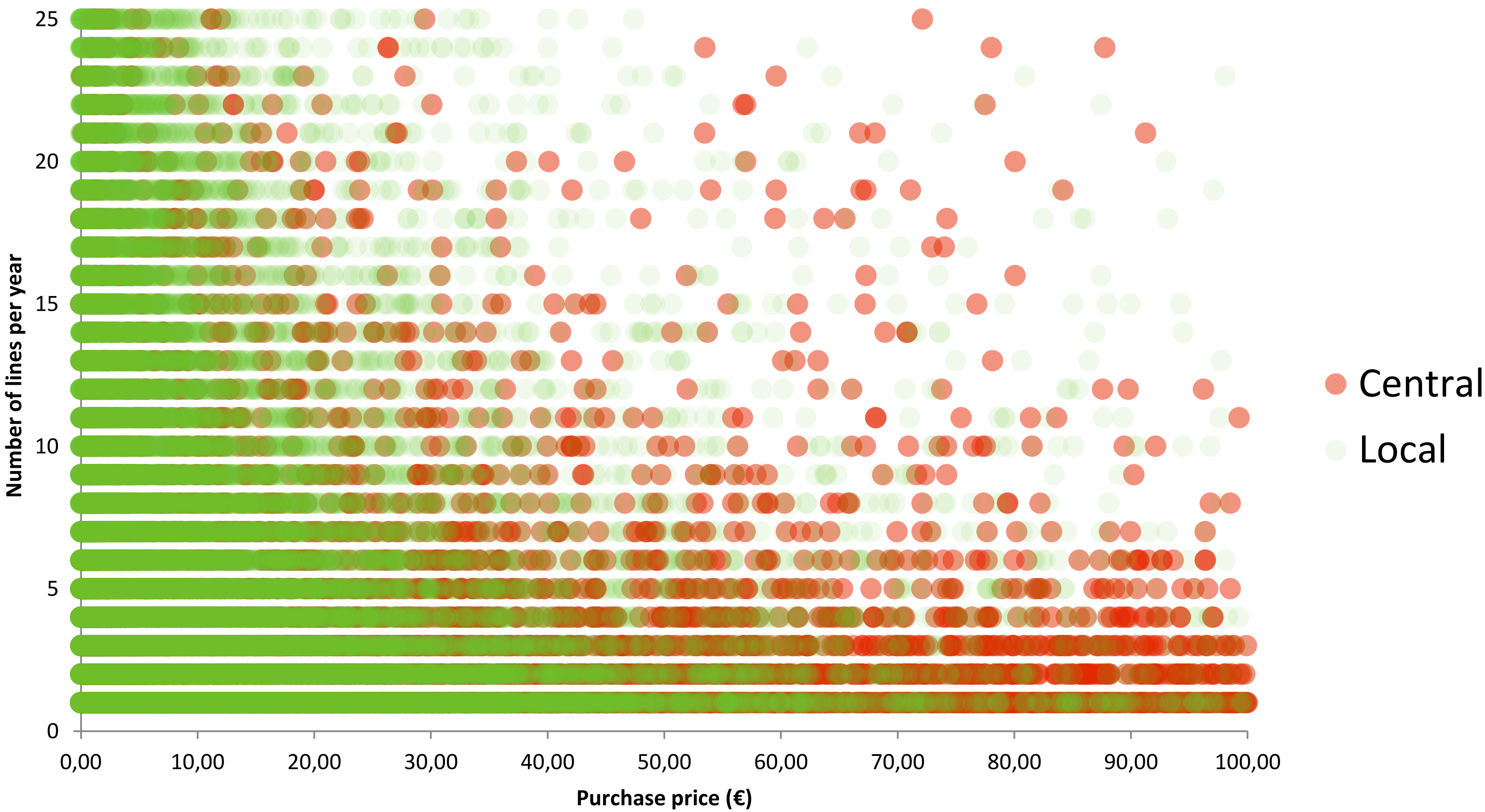
Make-To-Stock vs. Make-To-Order (FMCG case)

QUADRANT ANALYSIS



Where to stock (central vs. local)

INVENTORY & TRANSPORT COSTS



Inventory management scale

ASSES YOUR COMPANY INVENTORY MANAGEMENT MATURITY

	Level of professionalism in inventory management				
Symptoms	• Gut feeling inventory management • Many back orders • No idea about stock quantities and service level	• Days on inventory policies • Excel based computations • Inventory is monitored	• Basic statistic inventory calculations (P1) based on historic demand • ERP or Excel based computations • Inventory is monitored	• Demand and forecast planning • S&OP processes • Single echelon inventory optimization (P2) • Inventory is monitored	• Demand and forecast planning • S&OP processes • Multi-echelon inventory optimization • Inventory specialist
Service level:	**50-60%**	**60-80%**	**80-95%**	**Up to 99,9%**	**Up to 99,9%**
Potential:	**Base Case**	**Limited**	**20-30%**	**30-50%**	**> 50%**

Safety stock based on service levels and charges

SAFETY STOCK DECISION RULES

- **Safety stock based on service levels:**

  - Specified Probability **(P1)** of No Stockout per Replenishment Cycle – Cycle Service Level.
  - Specified Fraction **(P2)** of Demand to Be Satisfied Routinely from the Shelf – Fill Rate
  - Specified Fraction of Time **(P3)** During Which Net Stock is Positive –Ready Rate
  - Specified Average Time **(TBS)** Between Stockout Occasions

- **Safety stock based on charge per unit short:**

  - Specified Fractional Cost **(B1)** per Stockout Occasion
  - Specified Fractional Charge **(B2)** per Unit Short
  - Specified Fractional Charge **(B3)** per Unit Short per Unit Time

Decision rules for (s,Q) control system (1/3)

ASSUMPTIONS AND NOTATION

Assumptions

1. Demand is probalistic but average demand is stable
2. A replenishment order Q is placed exactly at the order point *s*
3. Orders must be received in the same order as ordered
4. Forecast errors have a normal distribution with no bias
5. Q has been predetermined
6. The costs of the control system are independent of *s*

Notation

k	safety factor
$p_{u\geq k}(k)$ a	probability that a unit normal (mean 0, standard deviation 1) variable takes on value of k or larger.
SS	safety stock, in units
X_l	forecast (or expected) demand over a replenishment lead time, in units
σ_l	standard deviation of errors of forecasts over a replenishment lead time, in units

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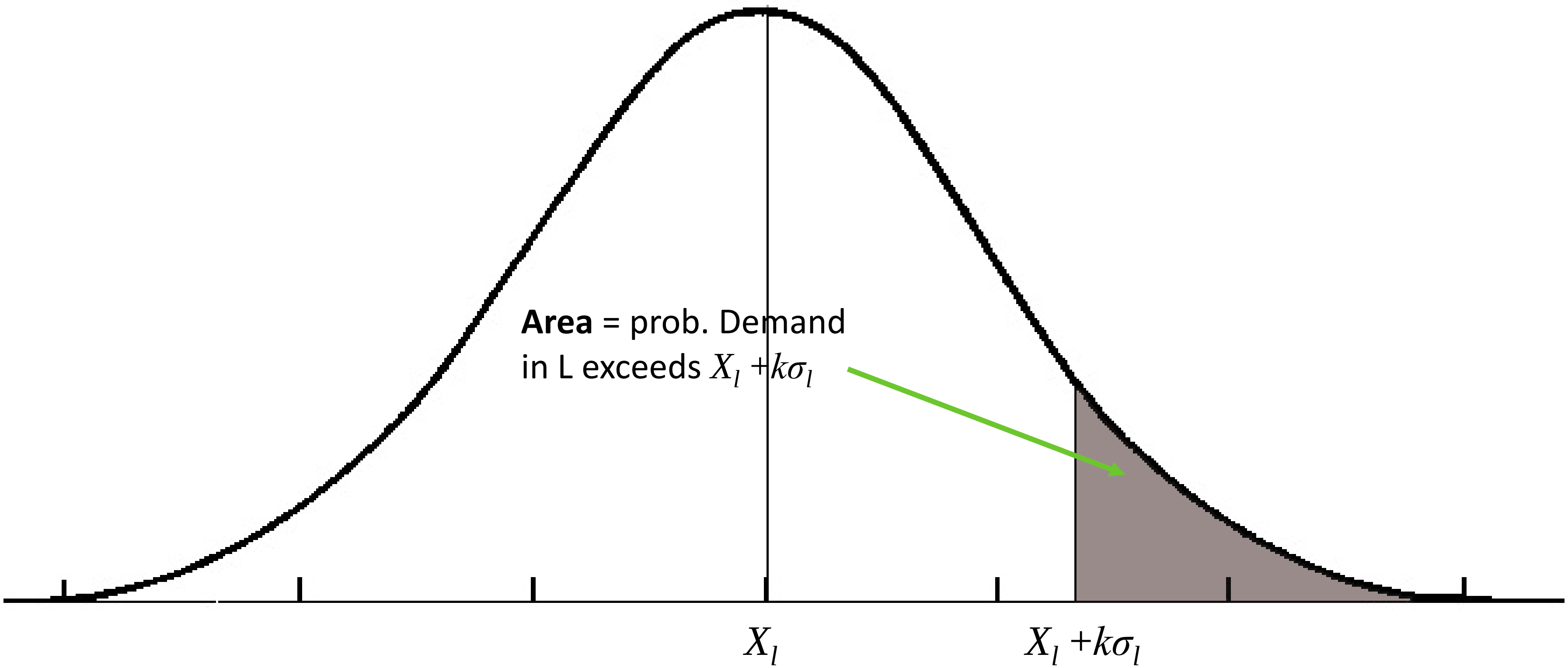
Decision rules for (s,Q) control system (2/3)

NORMALLY DISTRIBUTED FORECAST ERRORS



Decision rules for (s,Q) control system (3/3)

THE RULE

- **Step 1**: Select the safety factor k to satisfy

$$p_{u \geq k}(k) = 1\text{-}P_1$$

- **Step 2**: Calculate Safety stock

$$SS = k\sigma_l$$

- **Step 3**: Calculate reorder point

$S = X_l + SS$ (increased to the next higher integer if not already exactly an integer)

GROENEWOUT

Quick win of 20-30% inventory reduction

STATISTICAL BASIC INVENTORY OPTIMIZATION

- **Four steps**
  1. Historic demand data
  2. Distribution fitting to lead time demand
  3. Implementation of basic safety stock calculations
  4. Calculate (and simulate)

- **Frequent mistakes**
  - Incorrect formulas
  - Excluding uncertainty in supply
  - Misunderstanding of inventory position

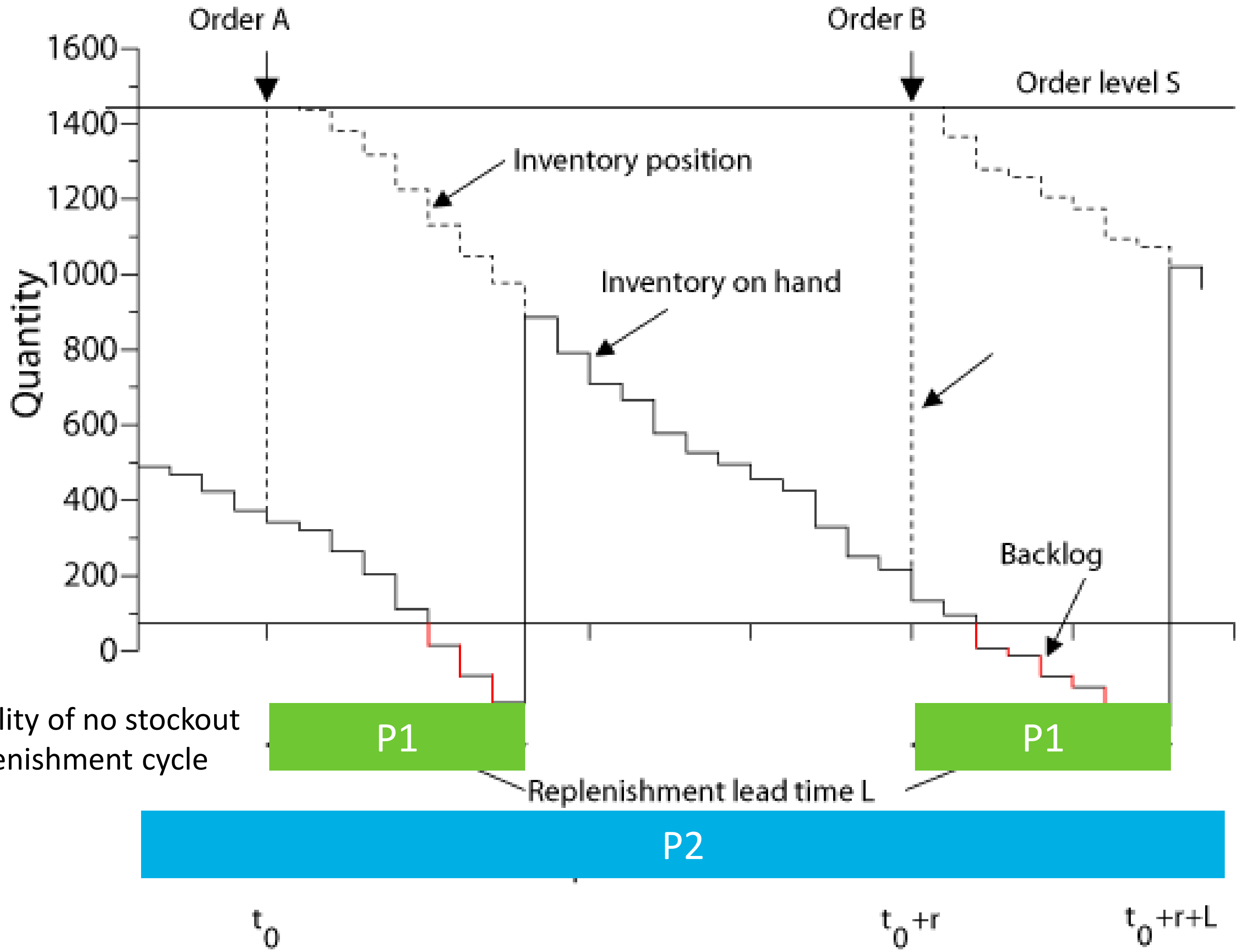
- **Best practices**
  - One year historic demand
  - Weekly time buckets
  - Frequency: twice per year

Case

$SS = k * \sigma_L$

Customer Service Level: P1 vs. P2

DIFFERENCE BETWEEN P1 AND P2 EXPLAINED



P1: Probability of no stockout during replenishment cycle

P2: Fill Rate

Potential of 30-50% by using P2

BESIDES DEMAND AND FORECASTING PLANNING CAN REDUCE VARIANCE IN LEAD TIME

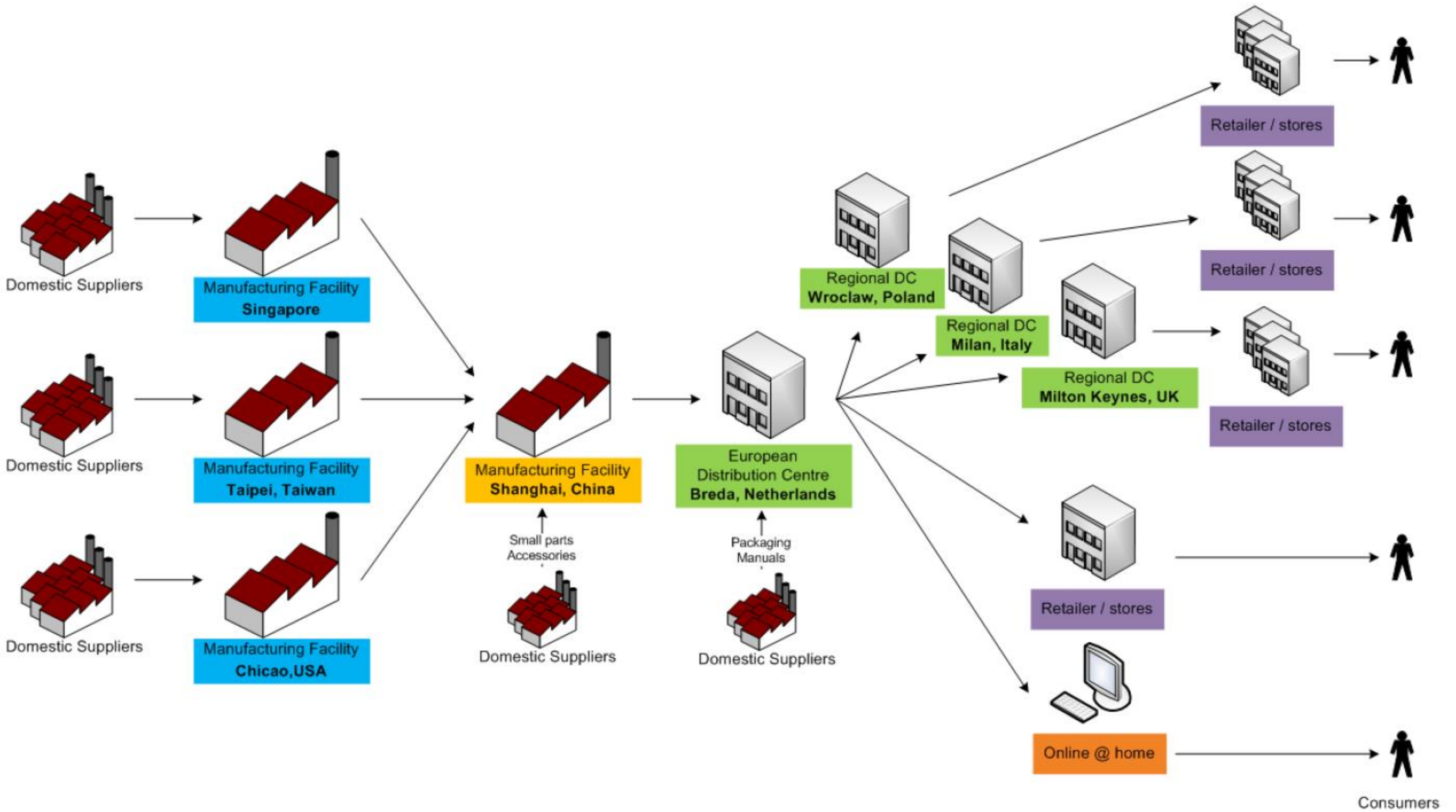
- **Approach**
  - The approach of P1 is similar to P2
  - Only a more complex distribution for the lead time demand is used
  - P2 can be implemented in Excel, but its more difficult

- **Frequent mistakes**
  - Using P1 in case of high order quantities leads to dead stock
  - Forecast error which is higher than the variance in demand

- **Best practices**
  - In case of high order quantities use P2
  - Demand and forecast planning is key in lowering safety stocks

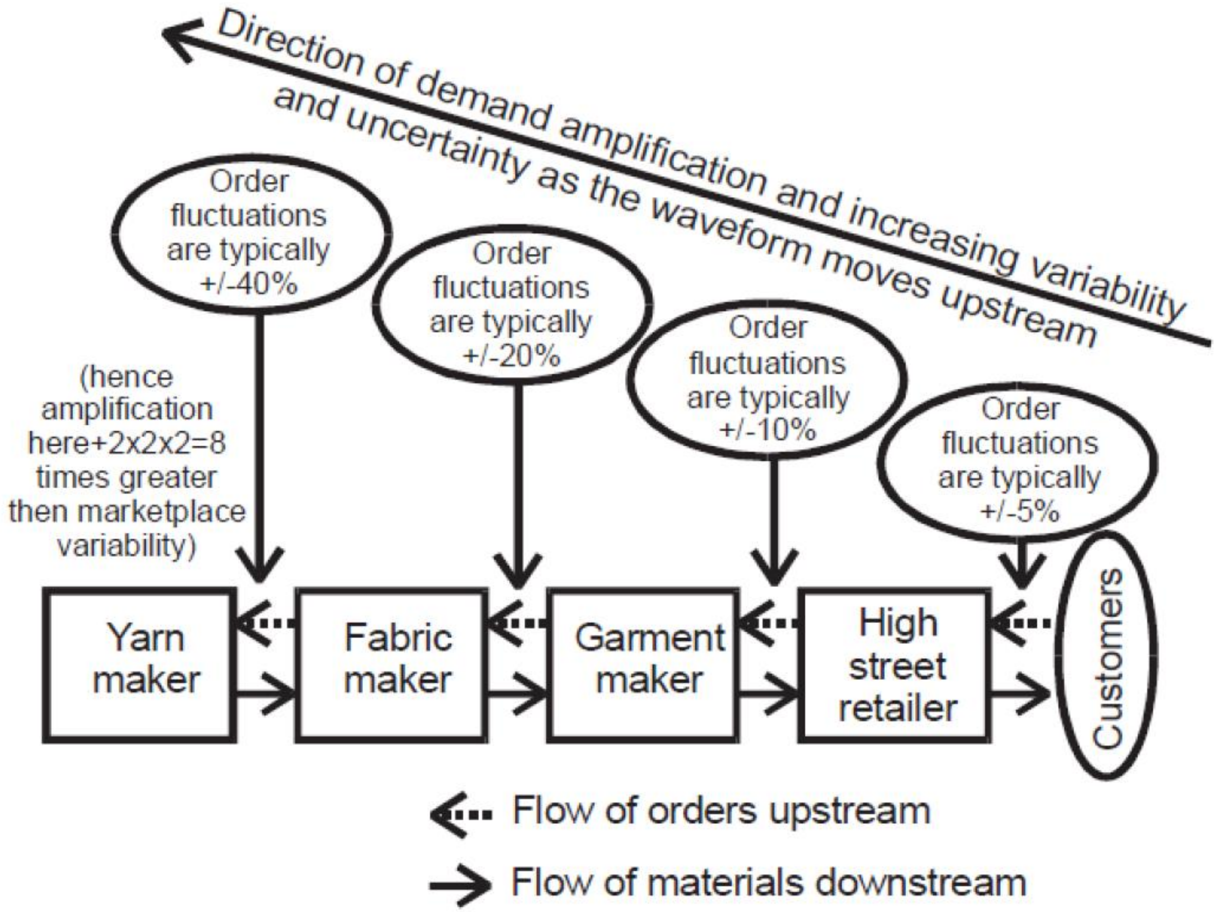
Multi-Echelon Inventory optimization

COMPLEX SUPPLY CHAINS WITH BILL OF MATERIALS

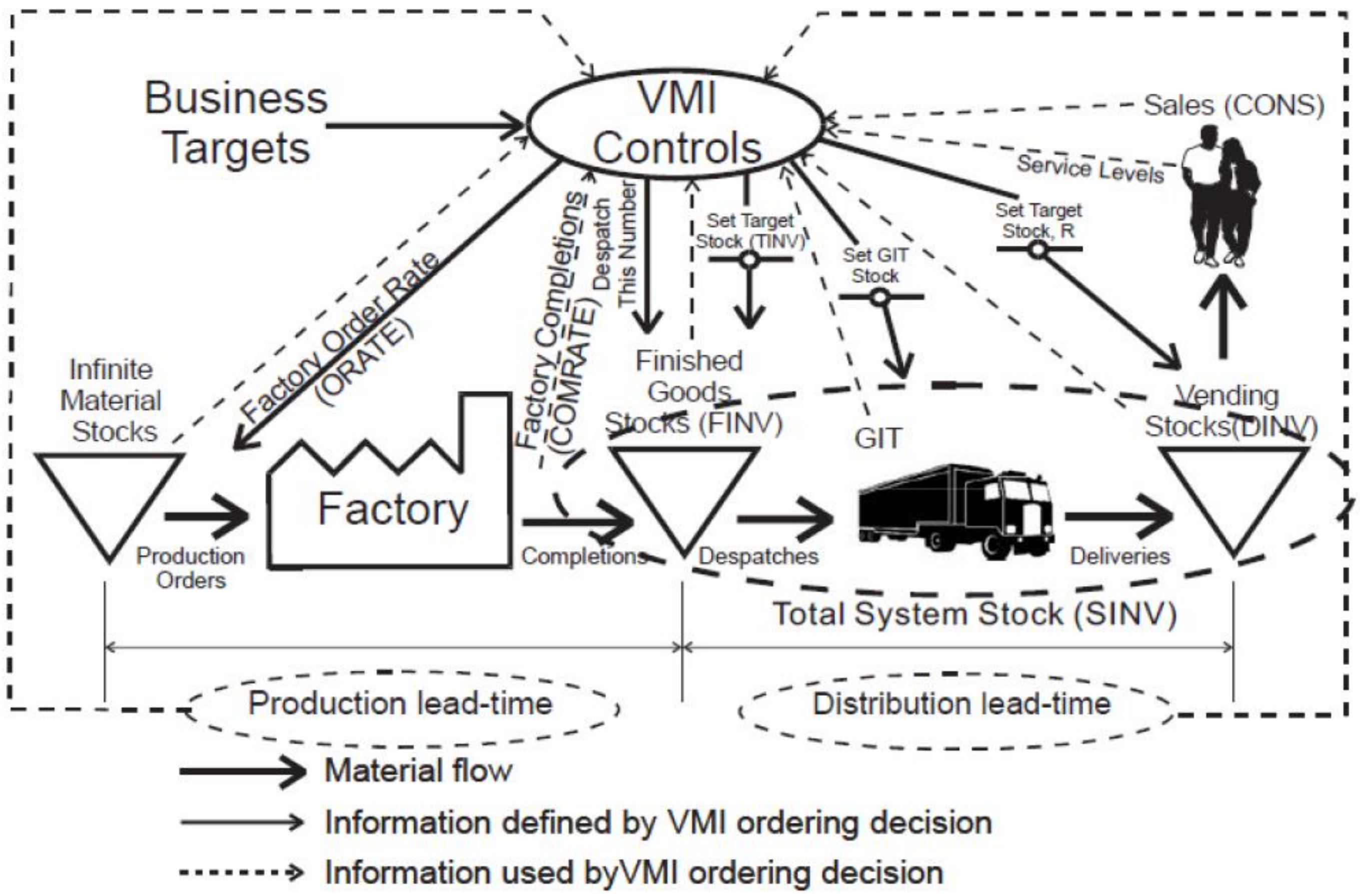


Bullwhip effect

FASHION EXAMPLE



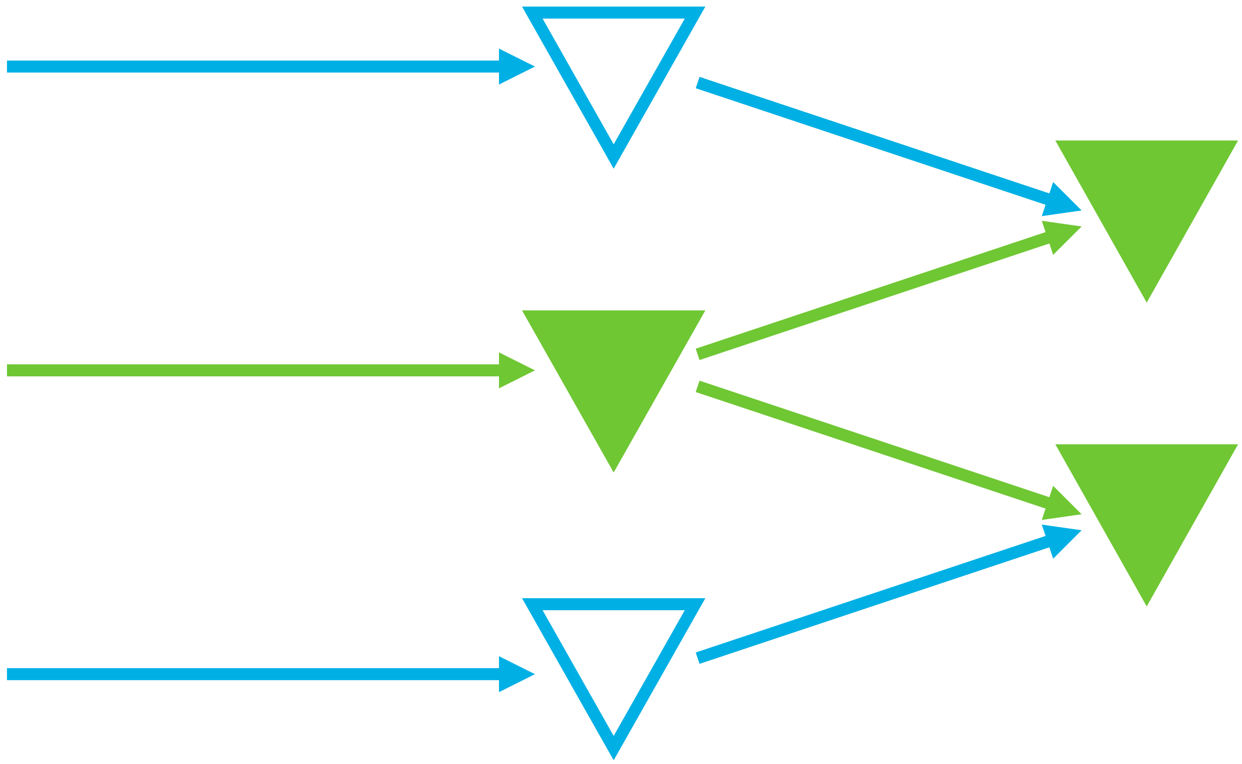
Vendor Managed Inventory & Collaborative Planning Concepts



Echelon Inventory Position

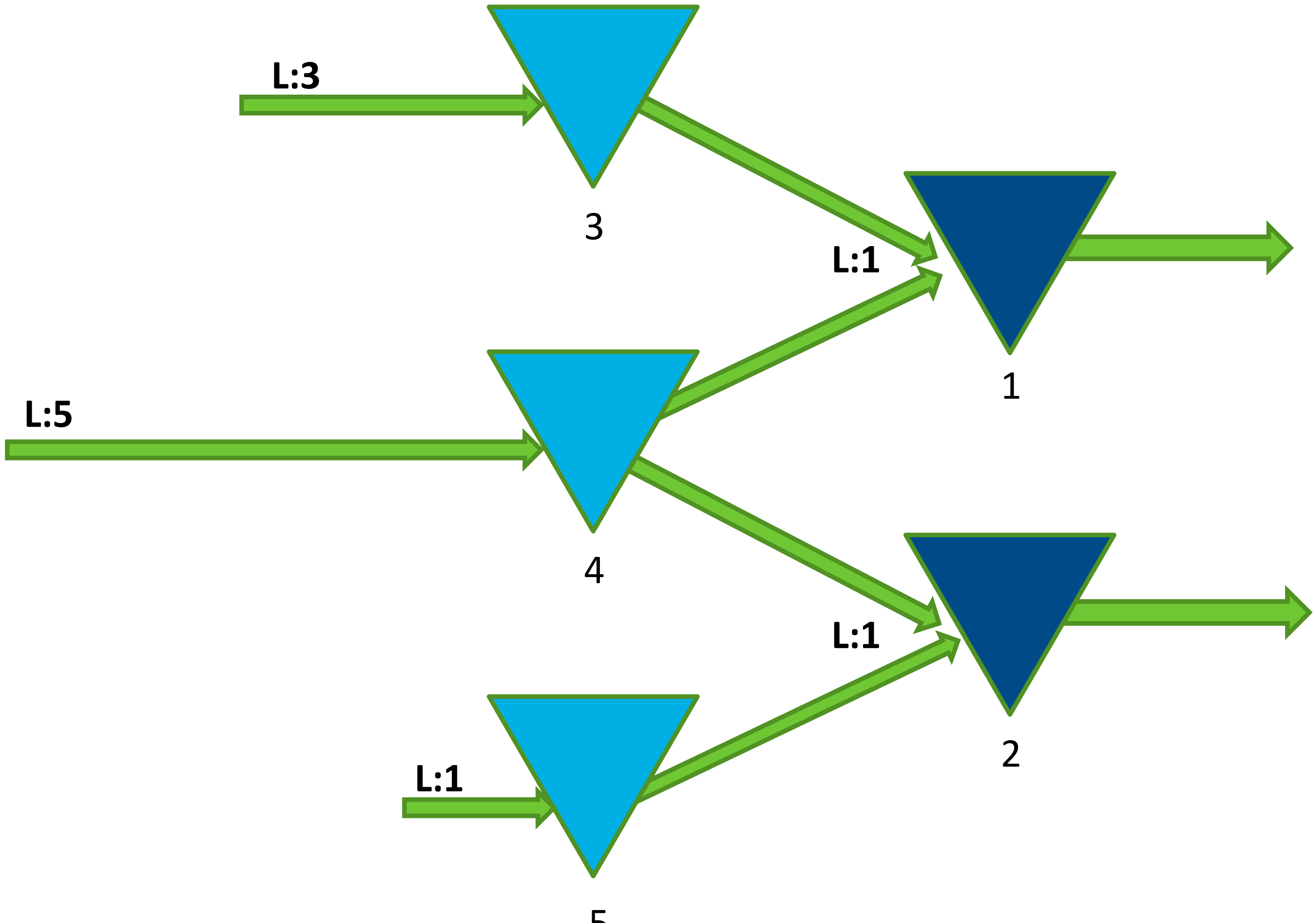
MULTI ECHELON CONCEPT

Echelon Inventory Position



Synchronized Base Stock Policy

AN EVOLUTION IN MATERIAL PLANNING



How it worked out for Philips

ELIMINATION OF THE BULLWHIP EFFECT

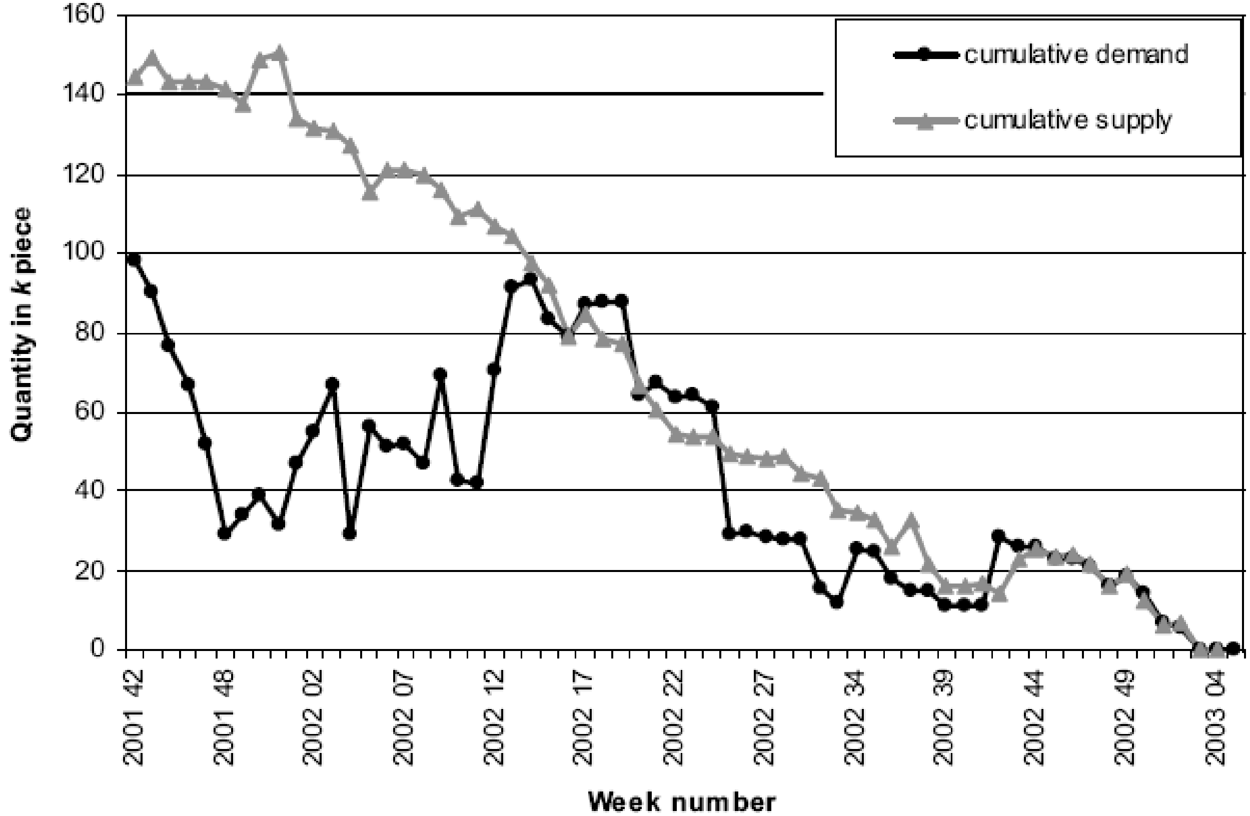
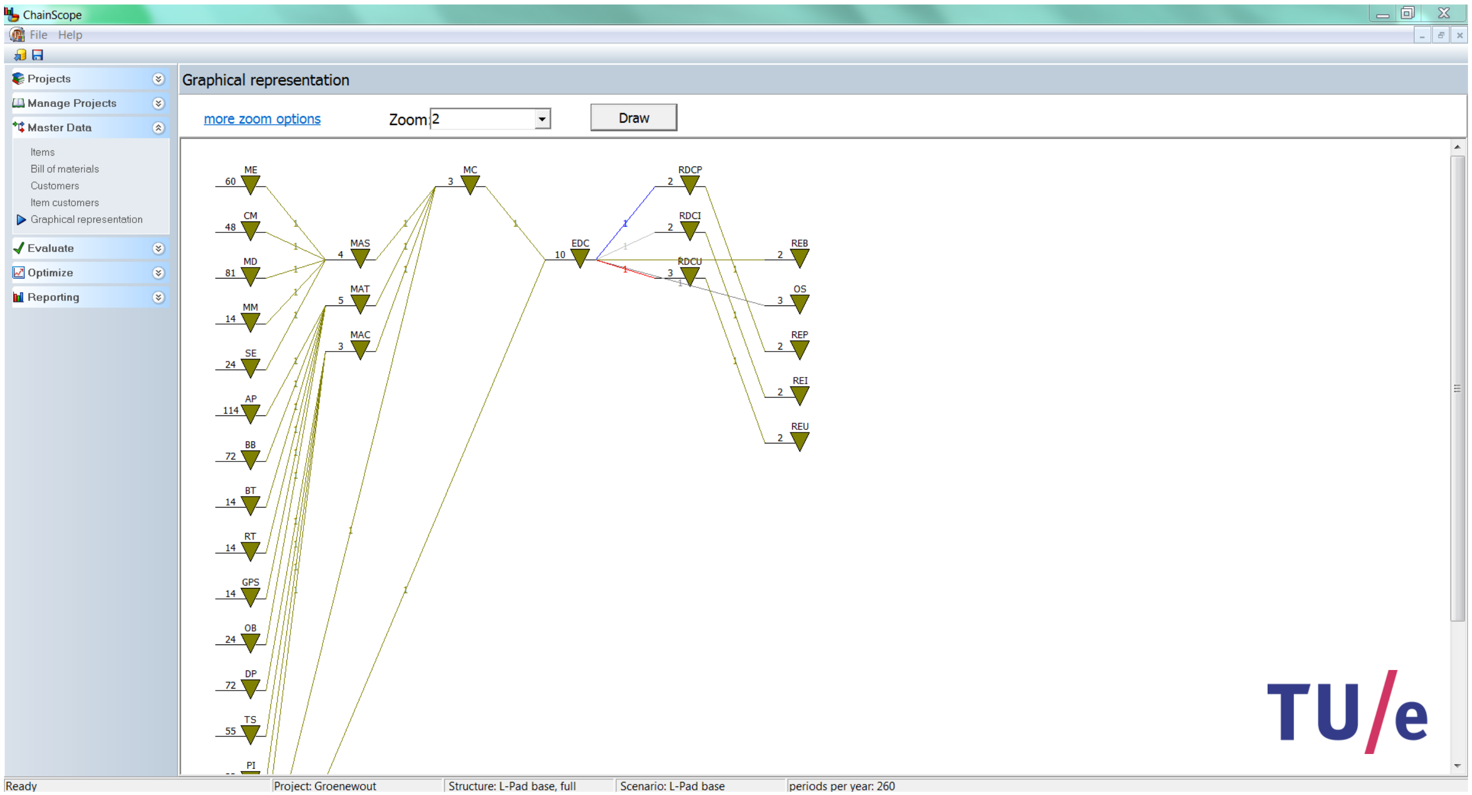


Figure 3: In a successful ramp-down at the end of the life cycle of a product, as a consequence of the new planning process, the gap between demand and supply decreased (first half of the graph), and then supply started following demand closely (second part of the graph) with almost no obsolescence at the end of the life cycle.

L-Pad Game

CHALLENGE AND TRIGGER YOUR SUPPLY CHAIN TEAM!



Where are you now and next year?

PLAY THE L-PAD GAME

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Play the L-Pad game to create awareness


which
who
what
where
how
why
when

DRIVEN BY KNOWLEDGE