Supply Chain Management

Introduction

Supply Chain Management:
- network of complex independent companies (conflictive objectives, dynamic)
- **M**anaging flow of **M**aterials, **I**nformation and **C**ash within supply chain, in an **E**ffective and **E**fficiënt manner through Coordination and Collaboration among **M**ultiple **E**nterprises (Keyword: collaboration among enterprises)

Supply Chain
- information flow
- material flow
- funds flow

Supply Chain
- Suppliers
- Manufacturers
- Distribution centers
- warehouses
- Customers

Key issues in Supply Chain Management
- Distribution Network Configuration
- Inventory Control
- Distribution Strategies
- Supply Chain Integration and Strategic Partnering
- Product design
- Information Technology an Decision-Support Systems
- Customer Value

Define a supplychain for a product (not for a company)

Vertical Integration is not always possible

Bullwhip-effect: Orderpeak and ordervariation increases as you move towards the upstream of the supplychain (Opslinger Effect)

Remedies bullwhip-effect
- Information sharing (Point of sale data; EDI)
- Chain integration (SCM;Efficiënt Consumer Response)
- Operational Efficëncy (Reducing leadtimes)

Causes / Remedies	Information Sharing	Channel Alignment	Operational Efficiëncy
Demand Forecast update	Point of sale data (POS) ; EDI Computer Aided Ordering (CAO)	Vendor managed Inventory (VMI) Direct sales	Lead time reduction
Order Batching	EDI	Outsourcing Consolidation	Set-up time reduction
Price Fluctuations		EDLP (every day low prices)	ABC approach

Two laws of supply chain dynamics influence product life cycles and volume variability in the supply chain:
- Bullwhip effect: Supply chain volatility increases as you move away from the end customer (volume uncertainty)
- Clockspeed effect: As you move closer to the end-customer in the supply chain, clockspeed increases and product life cycles get shorter (product uncertainty)

What is the value of: sharing the info ? ; reducing leadtime ?

Beer game
- value of informationsharing
- impact of long and short leadtimes
- difference between centralized and decentralized decision making

Risk Pool Game
- managing supply chain with or without any warehouse

Logistics Network Configuration

Warehouse costs: Handling costs ; Fixed Costs ; Storage Costs

Inventory turnover ratio=Annual sales/Average inventory level ;
Required storage space = 2 x average inventory level ; **Warehouse space** = 3 x Required storage space

Solution techniques
- Mathematical optimalisation (least cost solutions; good solutions)
- Simulation models to evaluate design alternatives (Use a two-stage approach)
  - optimization model (least cost solution)
  - simulation model to evaluate solutions

Two reasons for aggregating demand data:
- size of the model
- accuracy at the aggregated level

Strategies for managing inventory

Matching Supply and Demand

- Cycle inventory (economies of scale)
  - Carrying costs
  - Ordering costs
- Safety Inventory (supply/demand variability)
  - Carrying costs
  - Shortage costs
- Seasonal Inventory (seasonal variability)

Rules of inventory management:

1. forecast demand is always wrong (variability)
2. aggregated demand information is always more accurate than disaggregated data

Inventory

- Raw materials
- Work-in-process
- Finshed product inventory

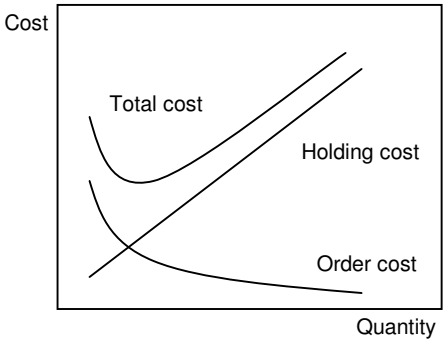
Why inventory?:

- to satisfy changes demand during lead time
- to protect against uncertainty in demand/supply
- economies of scale in transport (to balance annual inventory holding consts and annual fixed order costs)

Key factors affecting inventory policy:

1. Customer demand
2. Replenishment lead time
3. Number of different products
4. Length of planning horizon
5. Costs
   a. order costs (product)
   b. inventory holding costs (taxes;maintenance;Obsoloscence(value risk);Opportunity(invested money))
6. Service level requirement

Economic Lotsize Model: Economic Order Quantity $EOQ = Q^* = \sqrt{\frac{2KD}{h}}$ (K=fixed setup/order costs per order;D=Demand per year ;h=holding cost per unit or cost capital x cost per unit)



Number of orders= $N = \sqrt{\frac{Daha + Dbhb + Dchc}{2K}}$ Da=Demand A ; ha = holdingcost a ; K= cost per order (a,b,c)

Sales increase factor 20 => Inventory increase factor SQRT(20)

Average inventory = Safety Stock + Q / 2

Safety Stock = $s = z\sigma\sqrt{L}$ L=Supply lead time ; Demand = N(μ,σ) = Normally distributed with mean μ and standard deviation σ ; z = Service level

Reorder point = R = L μ + S

Total warehouse costs = Annual ordering costs + Annual cycle stock holding costs + Annual safety stock holding costs
= (D/EOQ) * K + (EOQ / 2) * h + S * h

Warehouses centralized: $\mu_{centralized} = \sum \mu$ and $\sigma_{centralized} = \sqrt{\Sigma\sigma^2}$

Centralized vs Decentralized: Trade offs

	Decentralization	Centralization
Inventory	High	Low
Response lead time	Low	High
Overhead cost	High	Low
Inbound transport cost	High	Low
Outbound transport cost	Low	High

Keypoints of centralization/pooling:
- benefit of risk pooling (higher coëfficient of variation)
- When two markets are positively correlated, benefits of risk pooling decrease
- E-business firms exploit these benefits

Other methods to achieve centralization benefits:
- Raw material communality / late customization
- Information centralization
- Product substitution

Vendor Managed Inventory (**VMI**) = Supplier Managed Inventory (**SMI**) = Consumer Product Replenishment (**CPR**) = Just In Time Distribution (**JITD**)

Benefit occur's when Vendor/Supplier own's the inventory;The more customers the higher the benefit;the more heterogeneous the bigger the benefit
- Fear
- Trust
- Incentive

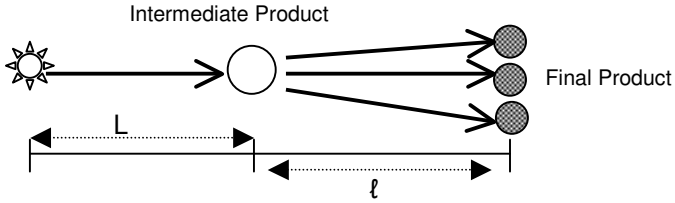
Vendor Managed Inventory (VMI)
- minimizes inefficiëncy
- involves shifting of internally and externally boudaries of control
- Shifting boundaries is a strategic issue (topmanagement)
- is a partnership of trust
  - capability or competence of controlling party
  - Controlling party must be willing to share the benefits

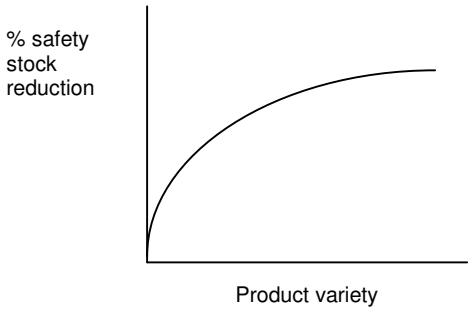
Distribution strategies

Postponement: Delaying point in time when a product assumes its identity (Delayed Product Differentiation)

Different Forms of DPD
- Postponing operations
- reversal of operation
- standardization

Necessary Conditions
- High Communality of modules among variety
- Modular product design
- Feasible to decouple primary and postponed operations





Postponement strategy Advantages due to Learning effect
- Reduction of forecasting horizon
- Accurate forecast using demand info obtained during L
- Better planning and Allocation of resources

Value of Postponement
- System-wide Safety Stock decreases
- Lower value of transit inventory
- As producty variety increases, % reduction of safety stock decreases but at a decreasing rate

When is Postponement valuable
- High product variety
- High demand uncertainty
- Short product life cycles
- Differentiation is not too costly
- High value "core-component", low value "differentiation component"

Managing Variety & Short Life Cycle: Delay the most uncertain decisions until better information is known and make Supply Chain more responsive

Types of distribution structure
- Direct Shipment (short lifecycle; high value product; bulky product)
  - Network
  - Milk-Runs
- Shipment via Central Distribution Center (storage/transit point)

Central Distribution Center
- Economies of scale (purchase)
  - High variable consumer demand
  - Lead time from warehouse to retailer is very quick
  - Lead time from factory to warehouse is long

- Cheaper storage space

Cross docking
- Low demand variability
- Fast leadtime supplier
- Supplier and retailer have IT sophistication
- High volume products/supplier

Cross-docking is the opposite of postponement

From SCM to Supply Chain Logistics

Logistics

Business Logistics		
Purchasing logistics	Production logistics	Distribution logistics
Physical supply	Material Management	Physical distribution
Reverse logistics		

Distribution Resource Planning (**DRP**)

Competitive logistics
- Costleadership
- Differentiation
- Integration

Customer service gap is the gap between the perception of the supplier and the perception of the customer

From Distribution logistics to Supply Chain Logistics

Basis concepten
- **Pareto** 80% percentage of sales comes out of 20% of the assortment
- **Porter portfolio**

Logistics structures
- Pipeline
- Chain
- Shared resource
- Convergent
- Divergent
- Network

Partnerships through Supply Chain Logistics

Four types of SCM
- Physical process
- Information (EDI, EAN electrical article numbering)
- Control (ECR efficient consumer response(food), QR quick response(confectie))
- Infrastructure

E-Business and its impact on Supply Chain

Trends in Supply Chain Management

Trends	Results	Challenges	Solutions
Globalization	Fragmentation of resources globally	Complex logistics, long lead time, high coordination	Quick response consolidation, outsourcing
Fast Change in Technology and Customer tastes	Short Product life cycle, uncertainty in demand	Matching supply and demand	Accurate Response, postponement
Needs for Customization	Mass customization / individualization	How to offer customization with less cost and less time	Modular design, Modular Production, postponement
IT/IS Trends	Availability of high capability IT-tools	Information sharing, less coordination costs	Internet / ERP

Other trends in SCM
- Collaborative Planning, Forecasting, Replenishment (CPFR)
- Strategic pricing
- Multi Vendor Consolidation
- E-commerce
- Scan Based Trading (lev krijgt betaald als product is verkocht)

Advanced Planning System (APS)
- ERP Manufacturer
- ERP Warehouse
- ERP Retail

Ketenomkering: Productie als verlengstuk van Distributie; Detailhandel=> Groothandel => Producent