Operations Management
Supply Chain Integration and Distribution

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Definition:

- All functions inside and outside a company that enable the delivery of a product or provision of a service to the (end) customer.

Terms:

- **Value Chain** (Porter 1985): defines cumulative value-added activities
- **Supply Chain** (Houlihan, 1985): logistics aspects of supply lines
- **Value Stream** (Lean Thinking, 1990): customer value perspective
- **Supply Network** (Harland, 1995): network effects need to be considered
- **Demand Network** (Christopher 1998): system is driven by demand, not deliveries

Information and Material Flows

- Information flow is the pace-maker (orders, schedules, forecasts)
- Material flow are the shipments against the orders (lot sizes!)
- Additional flows: payments, exchange of technical information
The scope of supply chain management

- First-tier suppliers
- Second-tier suppliers
- First-tier customers
- Second-tier customers

The operation

Supply side:
- Purchasing and supply management

Demand side:
- Physical distribution management

Logistics:
- Materials management
- Supply chain management
Supply Chain profit leverage example

Increase selling prices by 5% - difficult in competitive market and probably requiring additional marketing costs

Double Sales - extremely difficult due to capacity and other resource constraints

Decrease salaries by 25% or eliminate overheads - probably impossible

Decrease purchasing costs by 7.2% - in most cases obvious solution, particularly if extended to reductions in other SC costs such as transportation, packaging & materials handling
## Supply chain shift

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<tbody>
<tr>
<td><strong>Services</strong></td>
<td>Single function</td>
<td>Multi-functions</td>
<td>Integrated multi-functions, increased breadth and complexity</td>
</tr>
<tr>
<td><strong>Relationships</strong></td>
<td>Transactional</td>
<td>Longer-term arrangements</td>
<td>Strategic partnerships, mega-sized contracts</td>
</tr>
<tr>
<td><strong>Reach</strong></td>
<td>Local, regional</td>
<td>Multi-regional</td>
<td>Global, door-to-door coverage</td>
</tr>
<tr>
<td><strong>Competitive Landscape</strong></td>
<td>Fragmented</td>
<td>Consolidation/ alliance building</td>
<td>Small set of large alliances and niche providers</td>
</tr>
<tr>
<td><strong>Competencies</strong></td>
<td>Asset heavy, process execution</td>
<td>Shift from assets-based to information-based</td>
<td>Information/knowledge focus, integrated IT solutions</td>
</tr>
<tr>
<td><strong>Buyer Value</strong></td>
<td>Cost reduction</td>
<td>Cost avoidance, geographic expansion, enablement</td>
<td>Optimized cost and service</td>
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</tbody>
</table>

**Integrated Supply Chain Management**

**Contract Transportation/Distribution**

**Logistics Outsourcing**
Supply chain focus - shift

**Business**
- **B2B**
  - Relationship: Most common, all but last link in supply chain
  - E-commerce examples:
    - EDI networks
    - Tesco Information Exchange

**Consumer**
- **B2C**
  - Relationship: Retail operations, Catalogue operations
  - E-commerce examples:
    - Internet retailers
    - Amazon.com

**C2B**
- Relationship: Consumer ‘offer’, business responds
- E-commerce examples:
  - Airline ticket operators
  - Priceline.com

**C2C**
- Relationship: Trading ‘swap’ and auction transactions
- E-commerce examples:
  - Specialist ‘collector’ sites
  - Ebay.com

**From**
- Supplier
- Manufacturer
- Retailer
- Customer

**Methods**
- Lean production
  - Toyota
- Cross-docking and vendor managed inventory
  - Wal-Mart
- Forward Supply Chain
  - Dell, Office Depot, Lands’ End, FreshDirect

**Timeline**
- 1970s
- 1980s
- 1990s
- 2005
Demand amplification

- Certain dynamics exist between firms in supply chain that cause errors, inaccuracies and volatility
- Increase for operations further upstream.

Hence *Bullwhip effect*

- Small disturbance at one end of chain causes increasingly large disturbances as it works toward other end
- Magnification effect caused by delays in system, inaccuracy in forecasts, fears of ‘stock-out’, IS issues
Reasons for holding inventory

- **Anticipation Inventory**
  - Anticipate changes in customer demand, e.g. over holiday period

- **Decoupling Inventory**
  - Raw material inventory decouples organization from its suppliers
  - Work-in-process inventory decouples workstation from workstation
  - Finished goods inventory decouples organization from its customers

- **Safety or Buffer Inventory**
  - Protect against stockouts or price increases due to uncertainties in supply, demand and lead-times

- **Cycle Inventory**
  - Minimize purchasing and inventory costs by optimizing order cycles and ordering economic lot sizes
Push-pull supply chain boundary

Two sides of boundary have different requirements:

Push strategy
- Low uncertainty
- Long lead times
- Cost Minimisation
- Resource allocation

Pull strategy
- High uncertainty
- Short cycle times
- Focus on service
- Aim at responsiveness
Push and pull planning/control

**Push** planning and control

Push planning and control involves a forecasting process that informs the operations planning and control system. Instructions on what to make and where to send it are then distributed to the work centres. The operations planning and control system uses this information to coordinate delivery to the demand point.

**Pull** planning and control

Pull planning and control is initiated by requests from the demand point. These requests signal the need for specific products or services, which are then fulfilled by work centres. The delivery process then takes place, ensuring that the demand is met.

The diagram illustrates the flow of information and resources from forecast to demand, showcasing the principles of push and pull systems in operations planning and control.
Distribution strategies

![Diagram showing distribution strategies](image)
Independent Demand vs Dependent Demand

Finished goods unrelated to other items and often beyond the control of an organization

Raw materials, components & sub-assemblies converted into finished goods and controlled by an organization

**Fixed-Order Quantity System** (EOQ or Q systems)

**Fixed-time Period Systems** (also known as Periodic Review systems or Fixed-order interval or P systems)

**Material Requirements Planning (MRP)** - inventory scheduling planning & control system

**Manufacturing Resources Planning (MRP II)** - extended to all manufacturing resources

**Just-in-Time (JIT)** - based on elimination of inventory, waste

**Enterprise Resources Planning** - MRP II extended to entire organization and to supply chains
Generic Customer Order Decoupling Points

1. Sell from local stock
2. Make to Stock
3. Assemble to Order
4. Make to Order
5. ETO/Project
Tradeoffs

Purchase & manufacture to plan, creating inventory at the decoupling point

Assemble/finish to order from inventory at the decoupling point

Increase inventory & risk obsolescence

Fulfillment lead time

Market lead time

A familiar example – MTS vs ATO

Per sandwich costs:
patties $.40, other ingredients $.15, cook $.10, assemble $.10

Postponement: Moving the Fan-Out point Downstream

Add toppings at the point of customer order

- Milk Cows
- Process milk
- Mix
- Vanilla
- Freeze & Package
- Vanilla
- Ship
- Vanilla
- Strawberry
- Push-Pull point
  - Serve
  - Cookies
  - Cream
  - Butter
  - Brickle
Benetton example

- Postponement

Information about seasonal preferences

Acquire yarn → Dye yarn → Finish yarn → Knit parts → Assemble garment → Distribute

Information about seasonal preferences
Product Fan-Out &
the Push-Pull point

Postponement:
Moving the Fan-Out point Downstream

Add toppings at the point of customer order

Push-pull Progression:
Moving the Push-Pull Point Upstream

Steve's Ice Cream (a specialty shop in Boston)
## Network configuration: single vs multi-sourcing

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<thead>
<tr>
<th></th>
<th>Single Sourcing</th>
<th>Multi-Sourcing</th>
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<tbody>
<tr>
<td><strong>Advantages</strong></td>
<td>Potentially better quality</td>
<td>Purchaser can drive price down by competitive tendering</td>
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<tr>
<td></td>
<td>Strong, durable relationships</td>
<td>Can switch sources in case of supply failures</td>
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<tr>
<td></td>
<td>Better communication</td>
<td>Wide sources of knowledge to tap</td>
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<tr>
<td></td>
<td>More scale economies</td>
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<tr>
<td></td>
<td>Higher confidentiality</td>
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</tr>
<tr>
<td><strong>Disadvantages</strong></td>
<td>More vulnerable to disruption if supply failure occurs</td>
<td>Difficult to encourage commitment to supply</td>
</tr>
<tr>
<td></td>
<td>Individual supplier more affected by volume fluctuations</td>
<td>Less easy to develop effective service quality level</td>
</tr>
<tr>
<td></td>
<td>Supplier might exert upward pressure on prices</td>
<td>More effort at communication</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suppliers less likely to invest in new processes</td>
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</tbody>
</table>
Use of one source per product service offering

Advantages:
- Increased buying power/economies of scale
- Encourages long term contracts
- Encourages communication and sharing
- Less overhead
- Reduced indirect costs (Total Cost of Ownership approach)
- May ultimately reduce risk and control cost better

Duel/Parallel sourcing: two suppliers for similar parts across two product families

Advantage:
- Way to combine benefits of single and multiple sourcing: creative tension of co-operation and competition
Several suppliers per product/service offering
Focus on price and delivery - best deal
Advantages:
  – Reduces dependency on individual suppliers
  – Increases inter-supplier competition
  – Increases flexibility
  – Low risk of delivery failure
  – Spreading risk
Vertical Integration

**Direction**
Integration *backward* into supplier functions
Assures constant supply of inputs
Protects against price increases

Integration *forward* into distributor functions
Assures proper disposal of outputs
Captures additional profits beyond activity costs
Closer links with customers

**Extent**
Integration choice which value-adding activities to compete in
Effects of vertical integration

**advantages**

- problems easier to trace
- Operations schedules can be synchronized
- better forecasts
- control over technology
- can dictate volumes
- certain costs can be shared (R&D)

**disadvantages**

- less incentives to co-operate
- "guaranteed" customers given lower priority
- "guaranteed" customers given lower priority
- less focused
- market-based solutions often simpler
- less cost awareness
Effects of outsourcing

advantages

Supplier has specialised knowledge
Response can be built into contracts
Penalties in contracts can increase performance
Supplier capabilities may increase their ability to respond
Don’t have to worry about forecasts
Economies of scale through focus on specific operations

disadvantages

Communication of quality problems more difficult
Transport/delivery delays
Communication problems due to distance
Conflicting needs of different customers
Dependence on supplier’s ability
Increase in transaction costs

quality
speed
dependability
product flexibility
flexibility (volume/delivery)
cost
Types of supplier relationships

The character of Internal Operations Activity

Do Everything

Do Everything Important

Do Nothing

Resource Scope

Virtual Spot Trading

Virtual Operation

Vertically Integrated Operation

Traditional Supply Management

“Partnership” Supply Management

Long-term Virtual Operation

Market Relationship

Type of Inter-firm Contact

Transactional - Many Suppliers

Close - Few Suppliers
## New organisational model

<table>
<thead>
<tr>
<th></th>
<th>Traditional Enterprise</th>
<th>Collaborative Enterprise</th>
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</thead>
<tbody>
<tr>
<td>Corporate culture</td>
<td>Production</td>
<td>Collaboration</td>
</tr>
<tr>
<td>Management focus</td>
<td>Internal (capability)</td>
<td>External (opportunity)</td>
</tr>
<tr>
<td>Primary resources &amp; outputs</td>
<td>Tangible (product, physical)</td>
<td>Intangible (service, information)</td>
</tr>
<tr>
<td>Operational style</td>
<td>Vertical integration (pyramid)</td>
<td>Virtual integration (network)</td>
</tr>
<tr>
<td>Organisation</td>
<td>Function (vertical)</td>
<td>Process (horizontal)</td>
</tr>
<tr>
<td>Supplier interaction</td>
<td>Transaction</td>
<td>Relationships</td>
</tr>
<tr>
<td>IT integration level</td>
<td>Data (transactions)</td>
<td>Process (business rules)</td>
</tr>
<tr>
<td>Response</td>
<td>Push</td>
<td>Pull</td>
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### Illustration:

- **Control Need**: Full ownership, Partial ownership, Joint development, Retainer, Long-term contract, Call option, Short-term contract
- **Flexibility Need**: Potential Contract Relationships
- **Cartoon**: Price cuts - again, 50% cost reduction
Organisational structure supply chain role?
Supply chain relationships: Advantages of supply chain partnering

- Reliability - follow through on commitments
- Competence - choose a supply chain partner with a documented record of experience with the technology
- Information - sharing information assures the other partner that its interests will be protected
- Loyalty - stay in it for the long-term
- Partnership needs to be clearly defined from the start
- All partners should have the ability to initiate cost reductions
- Partnership should be evaluated based on performance
Managing supply chain relationships: Co-operative behaviours

- Co-operation – (Heide & John 1990)
- Strategic alignment (Stevens 1989)
- Partnership (Ellram & Cooper 1990)
- Risk and reward sharing (Cooper & Ellram 1993)
- Supplier integration (Bowersox & Closs 1996)
- Information sharing (Ellram & Cooper 1990)
- Process integration
Outsourcing

Benefits
- Economies of scale
- Risk Pooling
- Reduce capital investment
- Focus on core competencies
- Flexibility

Drawbacks
- Loss of competitive knowledge
- Loss of channel control to suppliers/competitors
- Conflicting objectives
- More complex supply chain
- Lead time and quality control

Diagram:
- Consumers
- Sainsbury
  - Retailer
- FMCG
  - Sainsbury private label
Make-or-buy decision: case for outsourcing

- Non-core
  - payroll
  - Billing
- Core
  - logistics
  - selling

- Purpose
  - reduce risk
  - reduce cost
  - keep ahead in market
  - free up money
  - focus on core
  - business transformation
  - retain flexibility
Reported outsourcing results

• Around half of all deals fail
  - structure, price performance
  - lack of strategic fit
  - lack of flexibility
  - subsequent service management issues
  - transition management

• Key shared values in negotiation
  - embedded value
  - option value
  - liabilities
  - exit cost

Source: McKinsey
Benefits of Effective Sourcing Decisions

- Better economies of scale achieved if orders aggregated
- More efficient procurement transactions significantly reduce overall cost of purchasing
- Design collaboration result in products that easier to manufacture and distribute, resulting in lower overall costs
- Good procurement processes facilitate coordination with suppliers
- Appropriate supplier contracts allow for risk sharing
- Lower purchase price by increasing competition through auctions
Kraljic’s supply matrix

Firm’s supply strategy should depend on two dimensions

- **profit impact**
  Volume purchased/ percentage of total purchased cost/ impact on product quality or business growth

- **supply risk**
  Availability/number of suppliers/competitive demand/ make-or-buy opportunities/ storage risks/ substitution opportunities

```
+----------------+----------------+----------------+----------------+
|                | High           | High           | Low            |
|                | Supply Risk    | Profit Impact  |                |
+----------------+----------------+----------------+----------------+
| High           | Bottleneck Items| Strategic Items | Non-Critical Items | Leverage Items |
|                | • Ensure supply | • Form partnerships | • Simplify and automate | • Exploit purchasing power and minimize cost |
| Low            | Low            | Profit Impact  |                |
+----------------+----------------+----------------+----------------+
```
# Fisher functional vs innovative products

## Functional Products
- Diapers, soup, milk, tiers
- Push is appropriate supply chain strategy
- Focus on efficiency, cost reduction, and supply chain planning

## Innovative products
- Fashion items, cosmetics, or high tech products
- Pull is appropriate supply chain strategy
- Focus on high profit margins, fast clockspeed, and unpredictable demand, responsiveness, maximizing service level, order fulfillment

<table>
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<tr>
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<th>Functional Products</th>
<th>Innovative Products</th>
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<tbody>
<tr>
<td>Product clockspeed</td>
<td>Slow</td>
<td>Fast</td>
</tr>
<tr>
<td>Demand Characteristics</td>
<td>Predictable</td>
<td>Unpredictable</td>
</tr>
<tr>
<td>Profit Margin</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Product Variety</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Average forecast error at time production committed</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Average stockout rate</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
**Greening Supply Chain: Reprocessing**

**REDUCE:** Reduction in use of materials
- e.g. reduce the generation of solid waste

**REUSE:** Re-use of materials
- e.g. returnable boxes, reusable packaging

**RE-ALLOCATE:** Extend use of waste
- e.g. by-products used for another purpose

**RECYCLE:** Collection and separation of material
- e.g. waste paper, plastics, Aluminium beer cans

**REMANUFACTURE:** (Resource Regeneration)
- e.g. single-use cameras, printer cartridges
Information systems role in supply chain

- **Information driver facilitates coordinated chain**
  - Pace maker for orders, schedules, forecasts
  - Enable SC extended planning and control development/use

- **Information *must-have* characteristics**
  - Accurate
  - Accessible in timely manner
  - Be of right kind
  - Secure (authentication, authorization, data integrity)

- **Internal integration followed by external** *(Newman et al., 2009)*
  - Integrated chain requires units within organization integrate before extended enterprise
  - Potential loss of control by subordinating goals of organization to overall supply chain
  - *Think big, but start small* *(Mentzer 2000)*

- **Most information sharing via “simple” technologies (phone, email)**
Lean agile split

Cost leadership

Competitive intensity of industry

Cost

Quality

Lean

Delivery speed

Delivery reliability

Diffenentiation

Mix flexibility

Agile

Volume flexibility

Agro-pharma example

LEAN

AGILE/RESPONSIVE

Raw Materials

Active Ingredient

Formulation

Filling & Packing

Distribution

Customers

Decoupling Point

6000 Raw Materials

70 Active Ingredients

- Purchased
- 8 AI Manufacturing Locations

· 30 FFP Locations
· Tollers / Contractors

6000 SKU’s
Dealing with uncertainty

Introduction of agile, taken from information systems (Naylor et al., 1999; Christopher, 1999, 2010), then leagile (Mason-Jones et al., 2000)
Followed by responsive (James-Moore, 1996), then fast (Swinney, 2010)

But
Not affecting lean principles
None dissimilar from “batch of one” lean other than greater emphasis on operationalisation (eg use of IT, firm networks)
Ethics for SCM
Corporate Social Responsibility?

- Where do supply chain responsibilities begin and end?
- Companies affected by supply chain ethics:
  - Nike
  - Gap
  - Nestle
  - Marks & Spencer ...
Current SCM challenges

- Product and technology life cycles shortening – performance dominated by time
- Increasing need for flexibility and responsiveness
- Global development of markets and supply
- Increasing number of strategically minded customers looking for strategic relationships with suppliers
- Expectation of high levels of variety – mass customisation
- Highly competitive market place
- Radical restructuring of corporate organisations – trend to outsource