Production Planning and Control

SUPPLY CHAIN MANAGEMENT

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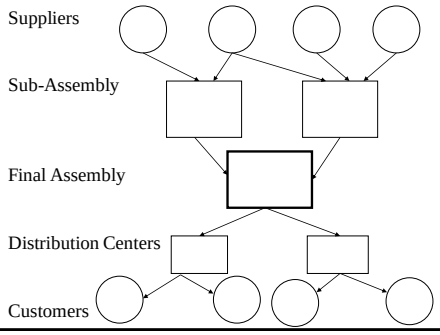
What is Supply Chain Management?

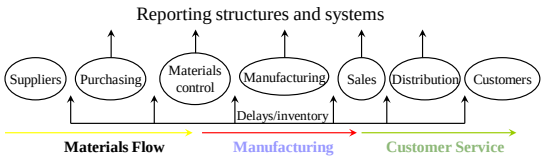
- *Supply Chain management deals with the control of materials, information, and financial flows in a network consisting of suppliers, manufacturers, distributors, and customers*
- *"Call it distribution or logistics or supply chain management... In industry after industry . . . Hard-pressed to knock out competitors on quality or price, companies are trying to gain an edge through their ability to deliver the right stuff in the right amount of time."* Fortune magazine article in 1994

The Supply Chain



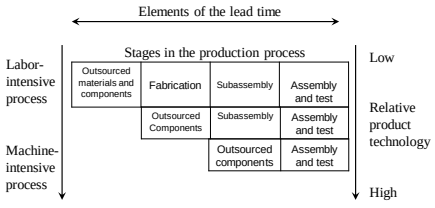
Considers the broad, integrated, view of materials management from purchasing through distribution

Why so much interest in Supply Chain Management recently?



As manufacturing becomes more efficient (or is outsourced), companies look for ways to reduce costs

Span of Process and Product/Process Technology:



With the rapid rate of component development, IT companies often must buy chips and other parts to keep pace with competition
- Bowmar / Texas Instruments in the calculators market
- Intel Corporation in PC design as a supplier of chips

Make-or-Buy Decisions

- *History*: Continuing Yesterday's Decisions
- The Dominance of Cost and Technology Arguments
- Shedding Difficult Manufacturing Tasks
  - Short-term gains: freed resources, reduced operating costs, access to world-class capabilities, increased focus on own core tasks
  - Long-term losses: loss of skill, essential manufacturing know-how, change in infrastructure *limits company's ability to respond* in the future

Make-or-Buy Decisions

- Costs and Investments
  - costs concerned with buying, selling and physically handling materials
  - improving the coordination between the supply, production and distribution activities
  - costs associated with combining similar overhead activities
  - investment in hardware, controls, procedures, and other relevant infrastructure requirements
- Strategic Considerations
  - High entry barriers, supply assurance, secured outlets

The Hollow Corporation:

- Low-cost manufacturing opportunities in the Far East, Eastern Europe, and Mexico has created an option to subcontract substantial parts of the existing processes and services for many US and Canadian companies
- "Ripple effect" means that for every $1 of imports there is a further substantial loss to a nation's economy as a whole. See table following the next slide

The Hollow Corporation:

- At the extreme, companies could be become industrial, corporate shells, relying on the other companies for manufacturing, services and many essential business functions – organization becomes more agile, flexible, and responsive; need less capital, have lower overhead
- Some manufacturing companies do little manufacturing!
- Hisashi Sakamaki (oversees manufacturing for Canon):
  "The key for us has been to figure out how to benefit from production overseas without losing our capacity to develop production at home. Most American firms rushed abroad and lost that knowledge"

The ripple effect concerns the real cost of imports to an economy. For each $1 billion of foreign-made consumables, it was estimated that the total cost to the US economy was $1.43 billion on top of $1 billion imports themselves.

Source: Data Resources Inc., Business Week, March 1988, p.61

Area of Cost of the Economy	**$ Millions**
Imported automobiles	1,000
Other vehicles engaged in hauling raw materials and finished goods	200
Steel and fabricated metal parts	184
Machine tools	98
Rubber and plastics	67
Nonferrous metals	46
Chemicals	40
Other manufacturing	343
Wholesale and retail margins, transportation, warehousing, and utilities	348
Mining	47
Finances and insurance	39
Plant construction	16
Total	**$2,428**

Supply Chain Management Issues:

- Globalization
  - widening choice of offshore suppliers
  - need to manage the global supply chain that emerges
- Incorporating Uncertainty
- Customer/Supplies Dependence
- Types of Supplier Relations
  - Trawling the market (little face-to-face interaction)
  - Ongoing relationships (information sharing, medium-term contracts)
  - Partnerships (extensive sharing of info, long-term contracts)
  - Strategic alliances (increased depth and breadth of the relationship)
  - Backward integration (change from relationship to ownership)
- Logistics Costs
  - Wrap, bundle, load, unload, sort, reload and move goods around
  - Box of cereal in US spends ~***140*** days getting from factory to supermarket

Examples of Customer/Supplier Relationship Developments in a Range of Industrial Sectors

Customer	**Customer/Supplier Development**
Hitachi (video equipment)	6 monthly supplier meetings at which Hitachi's CEO provides details of aggregate plans and policies to suppliers' top executives. Suppliers are grouped by categories of parts – cosmetic, electronic, mechanical, assembly. Each group has bimonthly 2-day meetings to resolve quality, technical, and delivery issues.
Volvo (cars)	75% of every car is made outside of Sweden. Parts and collected from suppliers and shipped to Gottenburg. Suppliers required to keep 2-4 weeks worth of stock. Pallets of parts not opened until moved to the assembly area, necessitating a guarantee on quality and quantity. Volvo provides a 12 month forecast: first 6 weeks are firm; next 12 weeks can vary, but Volvo accepts responsibility for materials and work-in-process inventory

Examples of Customer/Supplier Relationship Developments in a Range of Industrial Sectors

Customer	Customer/Supplier Development
Boeing (passenger airliners)	Design-build teams used on the 777 passenger airlines. First aircraft off the assembly line – parts are so accurate that the nose-to-tail measurement was less than 23 / 1,000 of an inch from design specification. Success build on computer-based design and the design-build teams used had included suppliers. Core to this success was the mutual respect and trust built up within the teams.
U.K. – based motor manufacturers	Forum established with experts from General Motors, Honda, Nissan, Toyota and Volkswagen. Purpose is for these major competitors to cooperate in educating and improving supplier base to the auto industry.
Canon (photocopiers and printers)	Sent own engineers to Daisho Denshi (a $0.25 billion maker of circuit boards and other parts) when it was on the verge of bankruptcy. Improvements in efficiency, quality conformance, and on-time delivery resulted. Led to Daisho Denshi cutting prices to Canon by 10%

Supply Chain Performance Measures:

Perspectives	Metrics	Measure
Supply chain reliability	On time delivery	Percentage
	Order fulfillment lead time	Days
	Fill rate	Percentage
	Perfect order fulfillment	Percentage
Flexibility and responsiveness	Supply chain response time	Days
	Upside production flexibility	Days
Expenses	Supply chain management cost	Percentage
	Warranty cost as percentage of revenue	Percentage
	Value added per employee	Dollars
Assets / utilization	Total inventory days of supply	Days
	Cash-to-cash cycle time	Days
	Net asset turns	Turns

Dell Designs the Ultimate Supply Chain

Dell Computer has been one of the most successful PC retailers. Why? To solve the problem of inventory becoming obsolete, Dell's solution:

Don't keep any inventory! - All PC's are made to order and parts shipped directly from manufacturers when possible. Compare to the experience of Compaq Corporation -- initial success selling through low cost retail warehouses, but did not garner web-based sales.

"Hot" laptop manufactured by Dell

Design for Logistics:

- Economic packaging and transportation
  - Designing products that can be efficiently packed and stored
  - Cheaper to transport:
    - redesign if products "cube out" before they "weigh out"
    - less storage space, stack easily, ship in bulk
- Concurrent and parallel processing
  - Modify the manufacturing process (product design)
    - Steps that were performed in sequence can now be completed at the same time
- Postponement / delayed differentiation
  - Aggregate demand information is more accurate than disaggregate data:
    - Re-sequencing, commonality, modularity, standardization

Designing For Supply Chain Efficiency 1: Postponement in Supply Chains

- Several companies have been able to cut costs and improve service by postponing the final configuration of the product until the latest possible point in the supply chain.
- Examples:
  - Bennetton Corporation producing "grey stock"
    - Major supplier of knitwear; in 1982 largest consumer of wool in the world
    - Nature of fashion industry: consumer preferences change rapidly
  - Hewlett Packard printer configuration
  - Postponement of final programming of semiconductor devices
  - Assemble to order rather than assemble to stock (Dell Computer)

Designing for Supply Chain Efficiency 2: Design for Logistics

- Many firms now consider SCM issues in the design phase of product development. (This has been referred to DFL or Design for Logistics).
- One example is IKEA whose furniture comes in simple to assemble kits that allows them to store the furniture in the same warehouse-like locations where they are displayed and sold.

Efficient Design of the Supplier Base

- Part of streamlining the supply chain is reducing the number and variety of suppliers. The Japanese have been very successful in this arena.
- Another example: In the mid 1980's Xerox trimmed its number of suppliers from 5,000 to 400.
- Overseas suppliers were chosen based on cost, and local suppliers were chosen based on delivery speed.

Shipping costs, Supply, and Demand Example Table 1.

From	***To***				
	City 1	***City 2***	***City 3***	***City 4***	***Supply (Million kwh)***
Plant 1	$8	$6	$10	$9	35
Plant 2	$9	$12	$13	$7	50
Plant 3	$14	$9	$16	$5	40
Demand (Million kwh)	45	20	30	30	

Transportation Tableau

"Barilla"

- Barilla was founded in 1875 by Pietro Barilla as a small shop in Parma, Italy. Pasta and bread were made in the adjoining "laboratory", and sold in the store.
- This family business grown from its modest beginnings into a large, vertically integrated corporation with flour mills, pasta plants, and bakery-product factories located throughout Italy.

"Barilla"

What made Barilla different from other 2,000 of Italian pasta manufacturers?

- High-quality product supported by innovative marketing programs
- Selling pasta in sealed cardboard box with recognizable color pattern rather than in bulk (1960s, investing in ads)

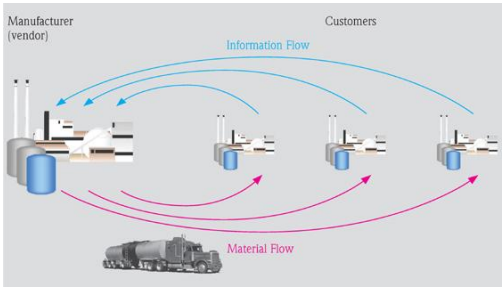
"Barilla"

In 1990 Barilla was organized into seven divisions:

- three pasta divisions (Narina, Voiello, and Braibanti),
- Bakery Products Division (manufacturing medium to long shelf-life bakery products),
- Fresh Bread Division (manufacturing very short shelf-life bakery products),
- Catering Division (distributing cakes and frozen croissants to bars and pastry shops), and
- International Division.

Information Transfer in Supply Chains: Vendor Managed Inventory

- Barilla SpA. Italian pasta producer. Pioneered the use of VMI (Vendor Managed Inventory). They obtained sales data directly from distributors and decide on delivery sizes based on that information (as opposed to allowing distributors to independently decide on order sizes).



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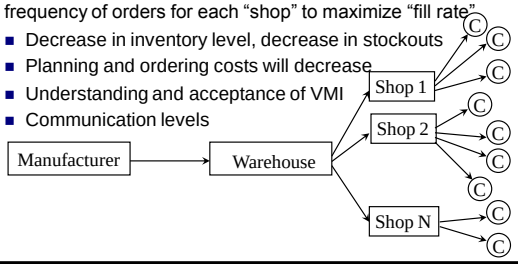
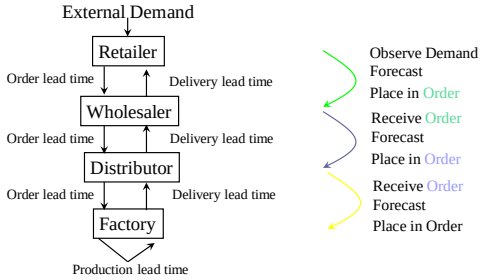
Vendor Managed Inventory

Positive and Negative aspects:

- Manufacturer does forecasting to determine the order size, frequency of orders for each "shop" to maximize "fill rate"
- Decrease in inventory level, decrease in stockouts
- Planning and ordering costs will decrease
- Understanding and acceptance of VMI
- Communication levels

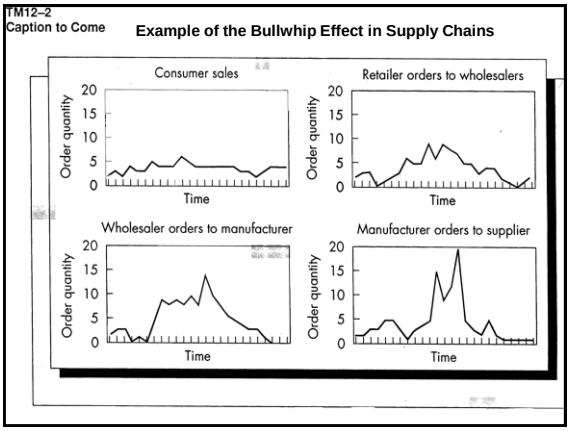


Information Transfer in Supply Chains: The Bullwhip Effect



Information Transfer in Supply Chains: The Bullwhip Effect

- First noticed by Procter & Gamble executives examining the order patterns for Pampers disposable diapers. They noticed that order variation increased dramatically as one moved from retailers to distributors to the factory.
- Problem:
  increases the difficulty of planning at the factory level



Factors Contributing to Bullwhip Effect

This is one of the problems

in the Homework #2!

The Explosive Growth of E-tailing: Electronic Commerce

- *E-tailing*: Direct to customer sales on the web. Perhaps best known e-tailer is Amazon.com, originally a web-based discount book seller. Today, many traditional "bricks and mortar" retailers also offer sales over the web, often at lower prices.
- E-commerce changed the way we work, interact, and do business. It allows to obtain meaningful product data, and do comparison, and transactions that follow through with error checking and correction capability.

B2B Supply Chain Management

- *B2B (business to business*) supply chain management: while not as visible and appealing as E-tailing, it appears that B2B supply chain management is the true growth industry. A search on Yahoo or Google yielded over 80 matches for supply chain software providers.
- Business-to-business electronic commerce (B2B) typically takes the form of automated processes between trading partners and is performed in much higher volumes than business-to-consumer (B2C) applications

Some of the major players in this market segment include:

- *Agile Software* based in Silicon Valley.
- *i2 Technologies* based in Dallas.
- *Ariba* based in Silicon Valley

Issues in International Supply Chain Management

- International (true global products) versus Regional (region-specific products) employ different strategies
  - Coca-Cola is essentially the same throughout the world, same as Levi's jeans and McDonald's burger
  - 1998 Honda Accord has 2 basic body styles (smaller to European and Japanese customers, and larger to North American consumers)
- Local Autonomy versus Central Control
- Differences in Logistics
  - Cultural Differences
    - Language – words, expressions, gestures, contest
    - Beliefs, values and customs – "efficiency", being on time, practice of gifts
  - Infrastructure
    - Highway systems, ports, communication and information systems
  - Human Resources

Trends in Supply Chain Management

- Outsourcing of manufacturing is a major trend
- Outsourcing of the logistics function
- Moving towards more web based transactions systems
- Improving the information flows along the entire chain