Supply Chain Management: Introduction

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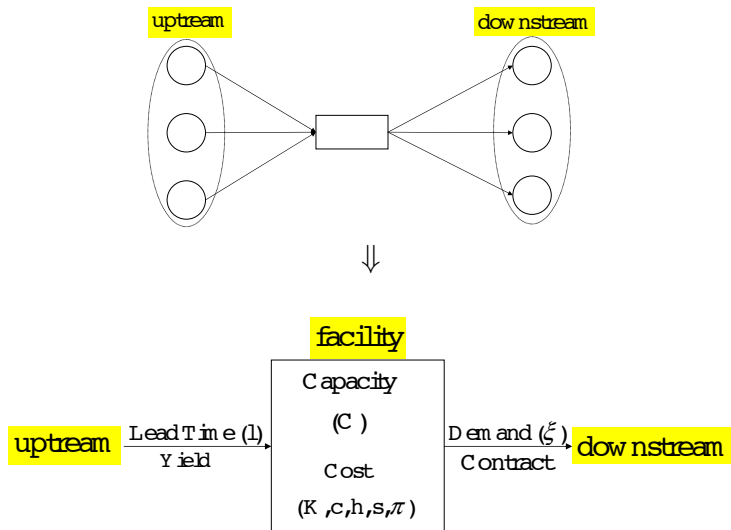
Section 1

What is supply chain?

Supply Chain (SC)

- A **Supply Chain** (SC) is a network of organizations—their facilities, functions, and activities—that are involved, through upstream and downstream linkages in the different processes and activities, in producing and delivering a product or service in the hand of the ultimate consumer.

- The sequence begins with suppliers of raw materials and extends all the way to the final customer. Each organization on the chain is both a supplier and a demander—except the first and the last on the chain.

- Three flow forms in a SC
  - **Material flow**: thus also known as logistics chain
  - **Information flow**: thus also known as information chain
  - **Finance flow**: thus also know as Value Chain.
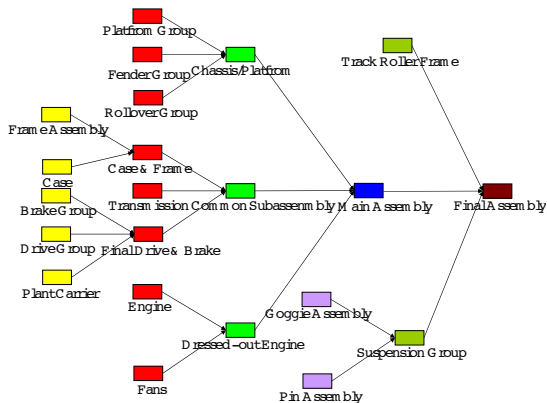
A bird's eye view of a typical SC
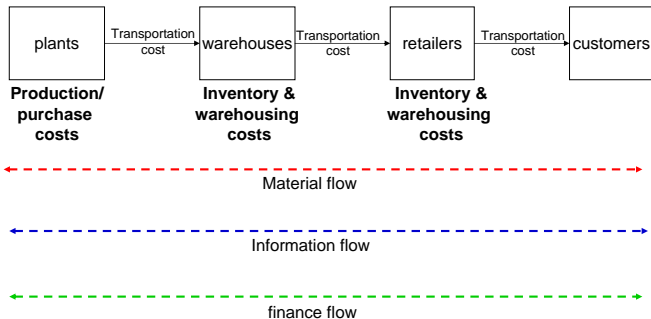
An eagle's eye view at one facility in a SC
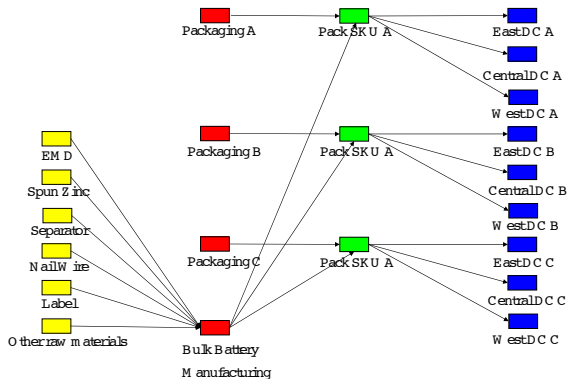
Some Supply Chain Examples I

- A bulldozer supply chain

Source: S.C.Graves and S.P.Willems (2003)

Some Supply Chain Examples II

- A battery supply chain

Source: S.C. Graves and S.P. Willems (2003)

Section 2

What is Supply Chain Management (SCM)?

Subsection 1

Supply chian management

Supply Chain Management

- **Supply Chain Management** (SCM) is a set of approaches utilized to efficiently integrate organization units—suppliers, manufacturers, warehouses and stores— along a SC, and coordinate flows—material, information and financial flows—so that merchandises is produced and distributed
  - at the right quantities
  - to the right locations
  - at the right time

In order to
  - optimize system-wide performance
  - satisfy customer service level requirements.

Section 3

What are the difficulties in SCM?

What are the difficulties in SCM? I

- The **development chain**: Supply chain strategies cannot be determined in isolation. They are directly affected by another chain that most organizations have, the *development chain* that includes the set of activities associated with new product introduction.

- **Global Optimization:** The process of finding the best *systemwide* strategy is known as global optimization.
  - It is challenging to design and operate a SC so that total systemwide costs are minimized and systemwide service levels are maintained.

- **Uncertainty Management:** The process of effectively dealing with uncertainty.
  - It is challenging to eliminate uncertainty from a SC.
  - Uncertainty arises as different forms

What are the difficulties in SCM? II

- certainty: no uncertainty
- risk: known probability distribution
- strict uncertainty: unknow probability distribution (a.k.a. random)

Subsection 1

The development chain

The development chain I

- The *development chain* is the set of activities and processes associated with new product introduction. It includes
  - product design phase: product architecture, make/buy decisions, and earlier supplier involvement
  - the associated capacities and knowledge that need to be developed internally:
  - sourcing decisions: supplier selection, supply contracts, and strategic partnerships
  - production plans:

The development chain II

- The development and supply chains interact at the production point:

Development chain

Plan/design
- Product architecture
- Make/buy
- Early supplier involvement

Source
- Strategic partnerships
- Supplier selection
- Supply chain contracts

Supply → Produce → Distribute → Sell
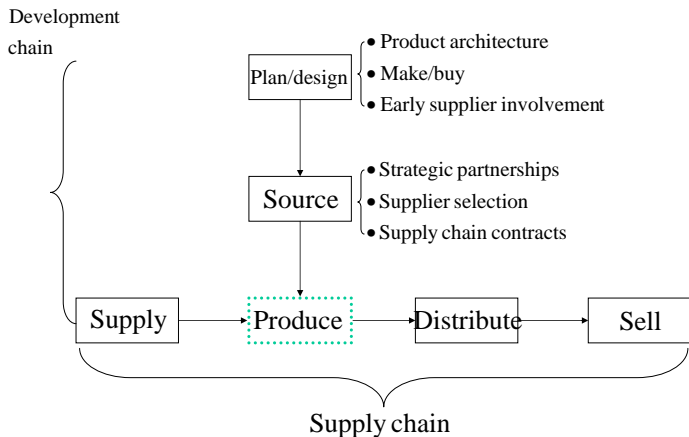
Supply chain

The development chain III

- In most organizations, different mangers are responsible for the different activities that are part of the development and supply chains
    - VP of engineering: development chain
    - VP of manufacturing: production portions of the chains
    - VP of supply chain or logistics: fulfillment of customer demands
- Misalignment of product design and supply chain strategies are typical.
- To make things worse, additional chains, such as the reverse logistics chain, and spare-parts chain, interact with both the development and the supply chains.

Subsection 2

Global Optimization

Global Optimization

- Why is it different/better than local optimization?

Sequential Optimization

Procurement Planning ← Manufacturing Planning ← Distribution Planning ← Demand Planning

Global Optimization

Supply Contracts/Collaboration/Information Systems and DSS

Procurement Planning ↔ Manufacturing Planning ↔ Distribution Planning ↔ Demand Planning
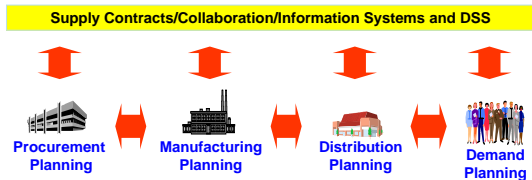
Source: *Duncan McFarlane*

Why is Global Optimization Hard?

- The supply chain is complex: facilities are dispersed over a large geography, and in many cases, all over the globe (more on next page).
- Different facilities have conflicting objectives (more later)
- The supply chain is a dynamic system that evolves over time: not only customer demands and supplier capacities change over time, but supply chain relationships also evolve over time. For example, as customers' power increases, there is increased pressure placed on manufacturers and suppliers to produce enormous variety of high-variety of high-quality products and ultimately to produce customized products.

An example showing the complexities of a supply chain: National Semiconductors

- Production:
    - Produces chips in six different locations: four in the US, one in Britain and one in Israel
    - Chips are shipped to seven assembly locations in Southeast Asia.
- Distribution
    - The final product is shipped to hundreds of facilities all over the world
    - 20,000 different routes
    - 12 different airlines are involved
    - 95% of the products are delivered within 45 days
    - 5% are delivered within 90 days.
- Competitors:
    - Motorola Inc.
    - Intel Corp.

What are conflicting supply chain objectives? I

- Purchasing (supplier)
    - Stable volume requirements
    - Flexible delivery time
    - Little variation in mix
    - Large quantities
- Manufacturing
    - Long run production
    - High quality
    - High productivity
    - Low production cost

- Warehousing
    - Low inventory
    - Reduced transportation costs
    - Quick replenishment capability

What are conflicting supply chain objectives? II

- Customers
  - Short order lead time
  - High in stock
  - Enormous variety of products
  - Low prices

What tools and approaches help with global optimization?

- Everything for optimization (Throughout this course, particularly Chapters 2 and 3))
- Strategic Alliances/Supplier Partnerships (Chapter 6)
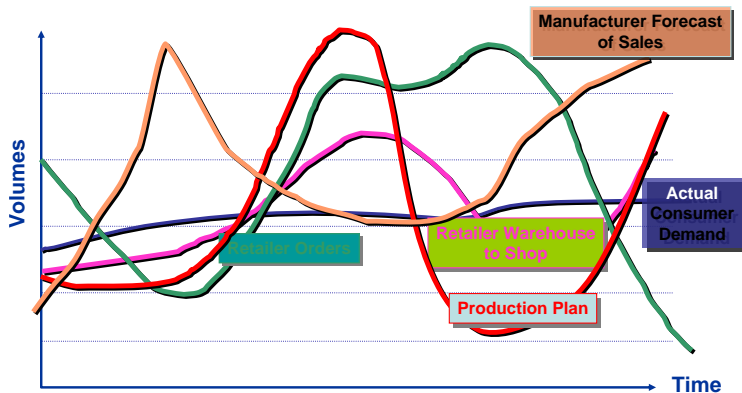- Supply Contracts/Incentive Schemes (Chapter 3)

Subsection 3

Uncertainty

Uncertainty I

- What is variation? What is randomness?

Supply Chain Variability

Volumes / Time

Manufacturer Forecast of Sales

Actual Consumer Demand

Retailer Orders

Retailer Warehouse to Shop

Production Plan
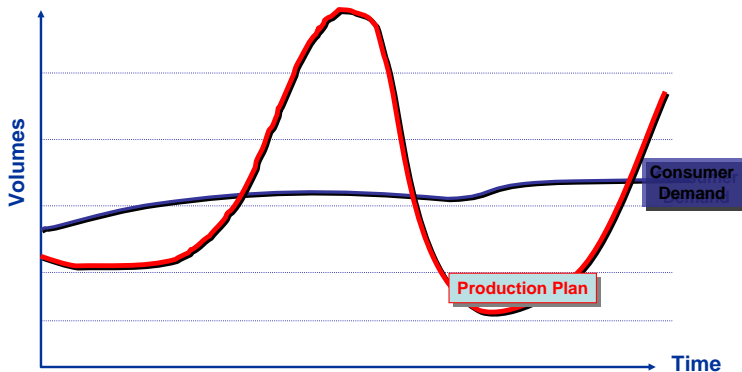
Source: Tom Mc Guffry, Electronic Commerce and Value Chain Management, 1998

What Management Gets...

Source: Tom Mc Guffry, Electronic Commerce and Value Chain Management, 1998

What Management Wants…
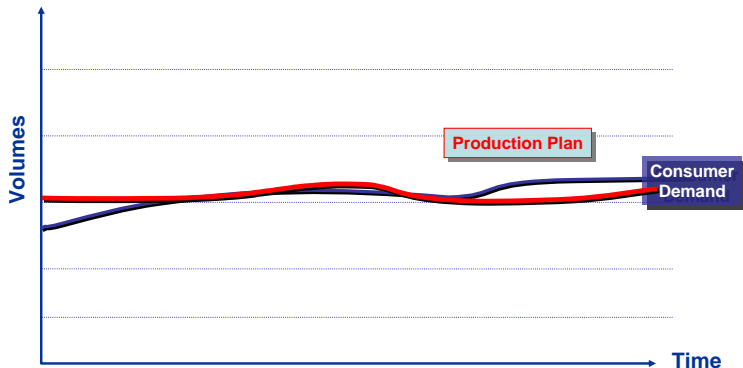
Source: Tom Mc Guffry, Electronic Commerce and Value Chain Management, 1998

Can't Forecasting Help?—**three golden rules on forecasting**

Rule 1: Forecasting is always wrong.

Rule 2: The longer the forecast horizon, the worse the forecast.

Rule 3: Aggregate forecasts are more accurate.

Why is uncertainty hard to deal With?

- Matching supply and demand is difficult.
- Forecasting doesn't solve the problem.
- Inventory and back-order levels typically fluctuate widely across the supply chain.
- Demand is not the only source of uncertainty:
  - Lead times
  - Yields
  - Transportation times
  - Natural Disasters
  - Component Availability

What tools and approaches help us to deal with these issues?

- Decision theory: decision making under uncertainty
- Pull Systems
- Risk Pooling
- Centralization
- Postponement
- Strategic Alliances
- Collaborative Forecasting

Section 4

Why do we need supply chain management anyway?!

Why do we need supply chain management anyway?! I

- Reducing cost is at its full potential already by using strategies such as jist-in-time, lean manufacturing, total quality management, and others—before 1990's.
- Effective supply chain management is considered to be the next step in increasing profit and market share.
  - In 1998, American companies spent $898 billion in supply-related activities (or 10.6% of gross domestic product). Among them
    - Transportation 58%
    - Inventory 38%
    - Management 4%
  - In 2000, this cost increased to $1 trillion and $6 billion.

Why do we need supply chain management anyway?! II

- Third party logistics services grew in 1998 by 15% to nearly $40 billion
- Unfortunately, this huge investment typically includes many unnecessary cost components in the supply chain due to
  - redundant stock
  - inefficient transportation strategies
  - other wasteful practices
- For example, it is believed that the grocery industry can save about $30 billion, or 10% of its annuanl operating cost by using more effective supply chain strategies.
  - It takes a typical box of cereal more than three months to get from the factory to a supermarket.

Why do we need supply chain management anyway?! III

- It takes a typical new car, on average, 15 days to travel from the factory to the dealership. This should be compared to the actual travel time, which is no more than four to five days.

- Therefore, many opportunities exist to cut costs in the supply chain. Not supprisingly, a number of companies have been able to substantially increase revenue or decrease costs through effective supply chain managment. We will see a few examples now.

Examples of effective SCM I

- Procter & Gamble estimates that it saved retail customers $65 million in a recent 18-moth supply chain initiative. According to Procter & Gamble, the essence of its approach lies in manufacturers and suppliers working closely together by forming *strategic partnerships* to jointly create business plans to eliminate the source of wasteful practices across the entire supply chain.

- In two years National Semiconductor reduced distribution costs by 2.5 per cent, decreased delivery time by 47 percent and increased sales by 34 percent by closing six warehouses around the globe and air-freighting microchips to customers from a new centralized distribution center in Singapore. This is achieved by a careful trade-off analysis between inventory and transportation costs, which leads to the *centralized warehousing*.

Examples of effective SCM II

- Home depot Inc's *direct shipping*: The Home Depot moves about 85% of its merchandises directly from suppliers to stores, avoiding warehouses altogther. In addition, since such a high volume of goods moves through its stores ($44 million in annunal sales on average), the products frequently are shipped in full trucks for addtional savings (econmy of scales).
- Wal-mark's success:
    - In 1979 Kmart was one of the leading companies in the retail industry, with 1891 stores and average revenue per store of $7.25 million.
    - At that time Wal-mart was a small niche retailer in the South with only 229 stores and average revenues about half of those of Kmart stores.

Examples of effective SCM III

- In 10 years Wal-mart had transformed itself; in 1992, it had the highest sales per square foot and highest inventory turnover and operating profit of any discount retailer. Today Wal-mart is the largest and highest-profit retailer in the world. In fact, as of 1999, Wal-mark accounted for nearly 5 percent of US retail spending.
- How did Wal-mark do it?
- The starting point was a relentless focus on satisfying customer needs; Wal-marlk's goal was simply to provide customers with access to goods when and where they want them and to develop cost structures that enable competitive pricing.
- The key to achieving this goal was to make the way the company replenishes inventory the centerpiece of its strategy. This was done by using a logistics techniques known as *cross-docking*.

Examples of effective SCM IV

- In this strategy, goods are continuously delivered to Wal-mart's warehouses, from where they are dispatched to stores without ever sitting in inventory.
- This strategy reduced Wal-mart's cost of sales significantly and made it possible to offer everyday low price to their customers.

Section 5

Key Issues in SCM

Key Issues in SCM I

Three-level Issues in SCM

Strategic Issues	Tactical Issues	Operating Issues
Design of the supply chain, partnering	Inventory policies Purchasing policies Production policies Transportation policies Quality policies	Quality control Production planning and control

- Issues span

Key Issues in SCM II

- Strategic: Decisions that have long-term effect on the firm, such as the number, the location and capacity of warehouses and manufacturing plants and the flow of the materials through the logistics network.
- Tactical: decisions that are typically updated anywhere between once every quarter and once every year, such as the purchasing, production, inventory and transportation decisions.
- Operational: day-to-day decisions such as scheduling, lead time quotations, routing, and truck loading.

Tradeoffs and issues

	Global optimization	Uncertainty	Level
Distribution Network Configuration	$\sqrt{}$		Strategic
Inventory control		$\sqrt{}$	Operational
Supply Contracts	$\sqrt{}$		Tactical
Distribution Strategies	$\sqrt{}$	$\sqrt{}$	Tactical
Integration and Partnerships	$\sqrt{}$		Strategic
Procurement Strategies and Outsourcing		$\sqrt{}$	Tactical
Product Design		$\sqrt{}$	Tactical
Information Technology	$\sqrt{}$	$\sqrt{}$	Strategic
customer value	$\sqrt{}$	$\sqrt{}$	Strategic