What is Supply Chain Management?

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What is a Supply Chain?

A supply chain consists of the flow of products and services from:

- Raw materials suppliers -to-
- Component and intermediate manufacturers/producers -to-
- Final product manufacturers/assemblers -to-
- Wholesalers and distributors -to-
- Retailers -to- The Customer

Connected by transportation and storage activities, and Integrated through information, planning, and integration activities.
What is a Supply Chain?
Paradigm Shift

Pre-1990s - Most firms were vertically oriented. The firm's employees performed all functions from product conceptualization thorough final sale and delivery. All manufacturing was done within the firm. There was *Central Control* of all operations.

1990s – Transportation costs dropped so that manufacturing could be performed anywhere in the world where the costs were appropriate. Outsourcing became a popular choice for manufacturing and assembly.
Today's Paradigm

Firms outsource design/manufacturing whenever and wherever and whenever appropriate. The firms are concerned about the environmental and societal effects of the product manufacturing and the effect of outdated products.

Corporate Social Responsibility – Reverse Logistics

Often a product a user receives will never be handled by an employee of the firm whose name is on its label.
Partners Across The Globe Are Bringing The 787 Together
New paradigm

A firm in a supply chain focuses activities in its area of specialization and enters into voluntary and trust-based relationships with supplier and customer firms. All participants in the supply chain benefit. Boundaries are dynamic and extend from the firm’s suppliers’ suppliers to its customers’ customers (i.e., second tier suppliers and customers).

Supply chains now deal with reverse logistics to handle returned products, warranty repairs, and recycling.
Manufacturing and Product Shipment are Global!
Outsourcing

Outsourcing: moving some of the firm's internal activities and decisions to outside providers

Question: When should the firm outsource activities?
Examples of outsourcing

Toshiba has outsourced manufacturing to Solectron. GM has outsourced its interior design to Delphi. Many firms outsource problem solving to McKinsey & Co.

Advertising is often outsourced completely. Many companies outsource logistics and transportation.
What Is the Goal of Supply Chain Management?

Supply chain management is concerned with the efficient integration of suppliers, factories, warehouses and stores so that merchandise is produced and distributed:

– In the right quantities
– To the right locations
– At the right time

In order to

– Minimize total system cost
– Satisfy customer service requirements
Right Quantity—Right Time—Right Place

Service: Strategic "What"

Cost: Operational "In what mix where"

Quality: Tactical "How much"
Why Isn't Supply Chain Management Easy?

Conflicting Objectives of Different Parties

Need for Global Optimization
Conflicting Objectives

1. Purchasing
   - Stable volume requirements
   - Flexible delivery time
   - Little variation in mix
   - Large quantities

2. Manufacturing
   - Long run production
   - High quality
   - High productivity
   - Low production cost
Conflicting Objectives

3. Warehousing
   • Low inventory
   • Reduced transportation costs
   • Quick replenishment capability

4. Customers
   • Short order lead time
   • High in stock
   • Enormous variety of products
   • Low prices
Local Optimization vs Global Optimization

Local Optimisation: What’s best for an operating silo

Global Optimisation: What’s best for the entire supply chain
Why Optimization is Hard

Need not only optimize each process or part, but Must do so simultaneously Including Transportation, Warehousing, Disposal, and Shrinkage Costs
The Boeing Extended Global Supply Chain

783 million parts are procured in one year

- 737: 400 thousand parts
- 767: 3.1 million parts
- 787: 2.3 million parts
- 777: 3 million parts
- 747-8: 6 million parts

$28 Billion spend • 5,400 factories • 500,000 people
Why Transportation is important!

It is estimated that the grocery industry could save $30 billion (10% of operating cost) by using effective logistics strategies.

A typical box of cereal spends more than three months getting from factory to supermarket.

A typical new car spends 15 days in transit from the factory to the dealership, although actual travel time is 5 days.
National Semiconductor Supply Chain

– 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
  Final product are shipped worldwide to 100s of facilities
  20,000 different routes
  12 different airlines are involved
  95% of the products are delivered within 45 days
  Remaining 5% are delivered within 90 days.
Can't we just forecast demand for a product?

Forecasting is always wrong

The longer the forecast horizon the worse the forecast

End item forecasts are even more wrong
Why Can't We Deal with Uncertainty?

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 About Variability?
Supply Chain Disruption

Small fire in New Mexico Chip Factory causes shortages of Cell Phones months later.

Source: The Resilient Enterprise
Why Supply Chain Management Is Important?

Cost savings and better coordination of resources are reasons to employ Supply Chain Management

- Reduced Bullwhip Effect - the magnified reduction of safety stock costs based on coordinated planning and sharing of information
- Collaborative planning, forecasting, and replenishment activities reduce the Bullwhip Effect and lead to better customer service, lower inventory costs, improved quality, reduced cycle time, better production methods, and other benefits.
But haven't we known about SCM for a long time?

1950s & 1960s

U.S. manufacturers focused on mass production techniques as their principal cost reduction and productivity improvement strategies.

1960s-1970s

New computer technology lead to development of Materials Requirements Planning (MRP) to coordinate inventory management and improve internal communication.
1980s & 1990s

Intense global competition led U.S. manufacturers to adopt

Supply Chain Management along with
Just-In-Time (JIT),
Total Quality Management (TQM),
and
Business Process Reengineering (BPR) practices
2000s and Beyond

Firms will rely more on *third-party service providers (3PLs)* to improve purchasing and supply management.

Wholesalers/retailers will focus on transportation and logistics more & refer to these as *quick response, service response logistics, and integrated logistics*.
Origins of Supply Chain Management

- Traditional mass manufacturing
- Inventory management & cost containment
- JIT, TQM, BPR, supplier & customer alliances
- Supply chain relationship formation and extension
- Increased supply chain capabilities

Time Periods:
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s
- Future
How will Supply Chain Management Effect an Engineer's Job!

Purchasing Trends:

• *Long term relationships*

• **Supplier management** - improve performance through
  • **Supplier evaluation** (determining supplier capabilities)
  • **Supplier certification** (third party or internal certification to assure product quality and service requirements)

• **Strategic partnerships** - successful and trusting relationships with top-performing suppliers
How will Supply Chain Management Effect an Engineer's Job!

Operations Trends:

Demand management- match demand to available capacity

• Linking buyers & suppliers via MRP and ERP systems
• Use JIT to improve the pull of materials to reduce inventory levels
• Employ TQM to improve quality compliance among suppliers
How will Supply Chain Management Effect an Engineer's Job!

Distribution Trends:

- **Transportation management**- tradeoff decisions between cost & timing of delivery/customer service via truck, rail, water & air

- **Customer relationship management**- strategies to ensure deliveries, resolve complaints, improve communications, & determine service requirements

- **Network design**- creating *distribution networks* based on tradeoff decisions between cost & sophistication of distribution system
Important Elements of Supply Chain Management

Integration Trends:

- **Supply Chain Process Integration** - when supply chain participants work for common goals. Requires **intra-firm** functional integration. Based on efforts to change attitudes & adversarial relationships.

- **Supply Chain Performance Measurement** - Crucial for firms to know if procedures are working.
Current Trends in Supply Chain Management

Expanding the Supply Chain

• U.S. firms are expanding partnerships and building facilities in foreign markets

• The expansion involves:
  • *Breadth* - foreign manufacturing, office & retail sites, foreign suppliers & customers
  • *Depth* - second and third tier suppliers & customers
Current Trends in Supply Chain Management

Increasing Supply Chain Responsiveness

• Firms increasingly need to be more flexible and responsive to customer needs.
• Supply chains need to benchmark industry performance and meet and improve on a continuous basis.
• Responsiveness improvement will come from more effective and faster product & service delivery systems.
The Greening of Supply Chains

• Producing, packaging, moving, storing, delivering and other supply chain activities can be harmful to the environment
• Supply chains can work harder to reduce environmental degradation
• A large majority (75%) of U.S. consumers are influenced by a firm’s environmental friendliness reputation
• Recycling and conservation are a growing alternative in response to high cost of natural resources.
The State of the Green Supply Chain

92% publicly share their sustainability goals

74% make sustainability brand promises

BUT ONLY 20% apply sustainability goals to their entire value network
Reducing Supply Chain Costs

Cost reduction achieved through:

• Reduced purchasing costs
• Reducing waste
• Reducing excess inventory, and
• Reducing non-value added activities

Continuous Improvement through

• **Benchmarking** - improve over competitors’ performance
• Trial & error
• Increased knowledge of supply chain processes
Conflict Minerals

Conflict minerals are minerals that are mined illegally to finance hostilities in the Democratic Republic of Congo or 9 countries surrounding Congo. US Secretary of State has determined that these minerals must be removed from US products. Companies examine their supply chain for traces of conflict minerals, that is tantalum, tin, tungsten, and gold from mines in central Africa.
Conflict Minerals

Rules require firms to
1. Determine whether the minerals are absolutely needed for the product
2. Determine where the minerals came from, either conflict-region and recycled or scrap from that region
3. Exercise due diligence regarding the source and chain of custody of there minerals.

Apple can map its supply chain to the smelter.
(Transport Topics – March 18, 2013)
Congo Conflict Materials Supply Chain

**Eastern Congo:**
- Armed groups control mines and transit routes, buy weapons, perpetrate violence

**East Asia:**
- Smelting or chemical processing companies process minerals into metals

**East Asia/Europe:**
- Manufacturing companies who make tin solder, capacitors, tinplate

**U.S., Europe:**
- Sold to consumers in cell phones, music players, and digital cameras

**Rwanda/Uganda/Kenya:**
- Minerals transported to refiners/smelters. Main actors: European metals traders

**East Asia:**
- Circuit board manufacturing companies place metals onto circuit boards
We can Protect Against using Conflict Materials

Smelters are the critical point of supply chain traceability

Source: A.T. Kearney analysis
Apple Juice Supply Chain

Supply Chain

Apple Farm ➔ Apple Juicing Plant ➔ National Distribution Centre (NDC) ➔ Regional Distribution Centre (RDC) ➔ Shops, Supermarkets, Vending Machines

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Forestry Supply Chain

Major Issues
- Maximise Value of Whole Tree
- Balancing Markets
- Forecasting Demand in Pull S.C.
- Using Price to Manage Push S.C.
- Complexity of SKU’s
- Complexity of Trade-offs
- Make or Buy.

Major Optimisation Issues
- Product Flow
- Product Push
- Demand Pull
- Third Party Buy-in

Log Yard
Sawmills
Woodchips
Sawdust
Moldings
Framing
Packaging
Pulp Mill

Forests
Pharmaceutical Supply Chain
Medical Nuclear Supply Chain

MO-99 --- TC-99m

Tc-99m supply chain: from NRU reactor to patients in Canada

STEP 1
NRU Reactor

STEP 2
Chalk River Labs
Bulk Processing

STEP 3
MDS Nordion
Processing & Purification

STEP 4
Private Sector
Generator Manufacturing

STEP 5
Regional
Distribution
Centers & Hospitals

STEP 6
Patients

Uranium-235 → Bulk Mo-99 → Mo-99 → Tc-99m → Tc-99m & Companion Drug

From reactor to patients - about 3-4 days (normal operations)

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Target Distribution Flow

Why    How    Process    Differences    Results

ScopeWest Conference—8/30/2010
The Smart Grid is a Supply Chain!

SMART GRID
A vision for the future - a network of integrated microgrids that can monitor and heal itself.

- **Storage**: Energy generated at off-peak times could be stored in batteries for later use.
- **Wind farm**
- **Industrial plant**
- **Offices**
- **Houses**
- **Disturbance in the grid**
- **Isolated microgrid**
- **Control power plant**

**Processors**: Execute special protection schemes in microseconds.

**Sensors**: Detect fluctuations and disturbances, and can signal for areas to be isolated.

**Generator**: Energy from small generators and solar panels can reduce overall demands on the grid.

**Smart appliances**: Can shut off in response to frequency fluctuations.

**Demand management**: Use can be shifted to off-peak times to save money.

A typical vision of a smart grid includes networks of micro-grids that can detect problems and disconnect themselves temporarily, demand-response equipment that shuts off nonessential appliances and other power drains if necessary, and sources of distributed power that can take some of the load off central power plants.
References


Slides from *Principles of Supply Chain Management: A Balanced Approach* by Daniel A. Glaser-Segura, PhD

Slides from Introduction to Supply Chain Management, by David Simchi-Levi, Philip Kaminsky, and Edith Simchi-Levi

Slides from *Basics of Supply Chain Management*, Stevens Institute of Technology
Engineering Degrees: Biomedical, Civil, Computer, Electrical, and Mechanical Engineering.

Joint Acoustical Engineering and Music degree with the Hartt School (the Conservatory at the University of Hartford)


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Thanks and Questions