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Basics of Supply Chain Management

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Definitions

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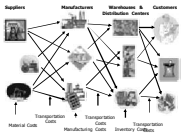
What Is the Supply Chain?

- Also referred to as the logistics network
- Suppliers, manufacturers, warehouses, distribution centers and retail outlets – "facilities"

and the

- Raw materials
- Work-in-process (WIP) inventory
- Finished products

that flow between the facilities



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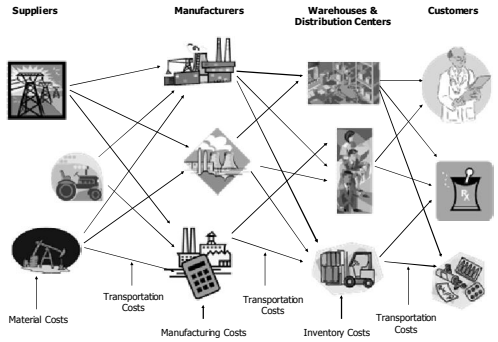
The Supply Chain



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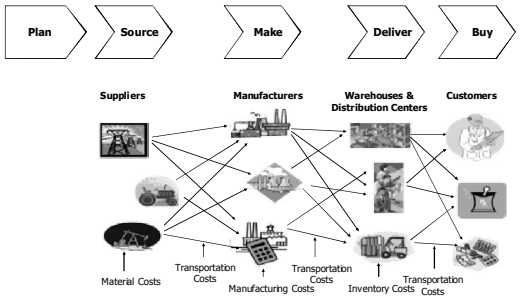
The Supply Chain – Another View



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What Is Supply Chain Management (SCM)?

- A set of approaches used to efficiently integrate
  - Suppliers
  - Manufacturers
  - Warehouses
  - Distribution centers
- So that the product is produced and distributed
  - In the right quantities
  - To the right locations
  - And at the right time
- System-wide costs are minimized and
- Service level requirements are satisfied

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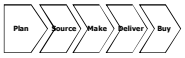
History of Supply Chain Management

- 1960's - Inventory Management Focus, Cost Control
- 1970's - MRP & BOM - Operations Planning
- 1980's - MRPII, JIT - Materials Management, Logistics
- 1990's - SCM - ERP - "Integrated" Purchasing, Financials, Manufacturing, Order Entry
- 2000's - Optimized "Value Network" with Real-Time Decision Support; Synchronized & Collaborative Extended Network

Why Is SCM Difficult?



- Uncertainty is inherent to every supply chain
  - Travel times
  - Breakdowns of machines and vehicles
  - Weather, natural catastrophe, war
  - Local politics, labor conditions, border issues
- The complexity of the problem to globally optimize a supply chain is significant
  - Minimize internal costs
  - Minimize uncertainty
  - Deal with remaining uncertainty

The Importance of Supply Chain Management

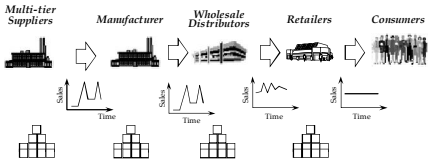
- Dealing with uncertain environments – matching supply and demand
  - Boeing announced a $2.6 billion write-off in 1997 due to "raw materials shortages, internal and supplier parts shortages and productivity inefficiencies"
  - U.S Surgical Corporation announced a $22 million loss in 1993 due to "larger than anticipated inventories on the shelves of hospitals"
  - IBM sold out its supply of its new Aptiva PC in 1994 costing it millions in potential revenue
  - Hewlett-Packard and Dell found it difficult to obtain important components for its PC's from Taiwanese suppliers in 1999 due to a massive earthquake
- U.S. firms spent $898 billion (10% of GDP) on supply-chain related activities in 1998

The Importance of Supply Chain Management

- Shorter product life cycles of high-technology products
  - Less opportunity to accumulate historical data on customer demand
  - Wide choice of competing products makes it difficult to predict demand
- The growth of technologies such as the Internet enable greater collaboration between supply chain trading partners
  - If you don't do it, your competitor will
  - Major buyers such as Wal-Mart demand a level of "supply chain maturity" of its suppliers
- Availability of SCM technologies on the market
  - Firms have access to multiple products (e.g., SAP, Baan, Oracle, JD Edwards) with which to integrate *internal* processes

Supply Chain Management and Uncertainty

- Inventory and back-order levels fluctuate considerably across the supply chain even when customer demand doesn't vary
- The variability worsens as we travel "up" the supply chain
- Forecasting doesn't help!



Bullwhip Effect

Factors Contributing to the Bullwhip

- Demand forecasting practices
  - Min-max inventory management (reorder points to bring inventory up to predicted levels)
- Lead time
  - Longer lead times lead to greater variability in estimates of average demand, thus increasing variability and safety stock costs
- Batch ordering
  - Peaks and valleys in orders
  - Fixed ordering costs
  - Impact of transportation costs (e.g., fuel costs)
  - Sales quotas
- Price fluctuations
  - Promotion and discount policies
- Lack of centralized information

Today's Marketplace Requires:

- **Personalized** content and services for their customers
- **Collaborative** planning with design partners, distributors, and suppliers
- **Real-time** commitments for design, production, inventory, and transportation capacity
- **Flexible** logistics options to ensure timely fulfillment
- **Order tracking** & reporting across **multiple vendors and carriers**

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Supply Chain Management – Key Issues

ISSUE	CONSIDERATIONS
Network Planning	• Warehouse locations and capacities • Plant locations and production levels • Transportation flows between facilities to minimize cost and time
Inventory Control	• How should inventory be managed? • Why does inventory fluctuate and what strategies minimize this?
Supply Contracts	• Impact of volume discount and revenue sharing • Pricing strategies to reduce order-shipment variability
Distribution Strategies	• Selection of distribution strategies (e.g., direct ship vs. cross-docking) • How many cross-dock points are needed? • Cost/Benefits of different strategies
Integration and Strategic Partnering	• How can integration with partners be achieved? • What level of integration is best? • What information and processes can be shared? • What partnerships should be implemented and in which situations?
Outsourcing & Procurement Strategies	• What are our core supply chain capabilities and which are not? • Does our product design mandate different outsourcing approaches? • Risk management
Product Design	• How are inventory holding and transportation costs affected by product design? • How does product design enable mass customization?

Source: Simchi-Levi

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Supply Chain Management – Key Issues

- Forecasts are never right
  - Very unlikely that actual demand will exactly equal forecast demand
- The longer the forecast horizon, the worse the forecast
  - A forecast for a year from now will never be as accurate as a forecast for 3 months from now
- Aggregate forecasts are more accurate
  - A demand forecast for all CV therapeutics will be more accurate than a forecast for a specific CV-related product

Nevertheless, forecasts (or plans, if you prefer) are important management tools when some methods are applied to reduce uncertainty

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Supply Chain Management Operations Strategies

STRATEGY	WHEN TO CHOOSE	BENEFITS
Make to Stock	standardized products, relatively predictable demand	Low manufacturing costs; meet customer demands quickly
Make to Order	customized products, many variations	Customization; reduced inventory; improved service levels
Configure to Order	many variations on finished product; infrequent demand	Low inventory levels; wide range of product offerings; simplified planning
Engineer to Order	complex products, unique customer specifications	Enables response to specific customer requirements

Source: Simchi-Levi

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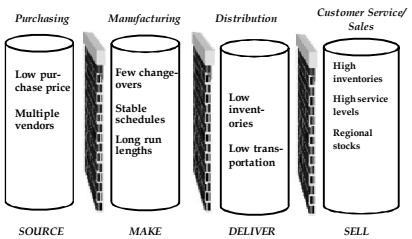
Supply Chain Management – Key Issues

- Overcoming functional silos with conflicting goals



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Supply Chain Management – Benefits

- A 1997 PRTM Integrated Supply Chain Benchmarking Survey of 331 firms found significant benefits to integrating the supply chain

Delivery Performance	**16%-28% Improvement**
Inventory Reduction	**25%-60% Improvement**
Fulfillment Cycle Time	**30%-50% Improvement**
Forecast Accuracy	**25%-80% Improvement**
Overall Productivity	**10%-16% Improvement**
Lower Supply-Chain Costs	**25%-50% Improvement**
Fill Rates	**20%-30% Improvement**
Improved Capacity Realization	**10%-20% Improvement**

Source: Cohen & Roussel

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Supply Chain Imperatives for Success

- View the supply chain as a strategic asset and a differentiator
  - Wal-Mart's partnership with Proctor & Gamble to automatically replenish inventory
  - Dell's innovative direct-to-consumer sales and build-to-order manufacturing
- Create unique supply chain configurations that align with your company's strategic objectives
  - Operations strategy
  - Outsourcing strategy
  - Channel strategy
  - Customer service strategy
  - Asset network

  } Supply chain configuration components
- Reduce uncertainty
  - Forecasting
  - Collaboration
  - Integration

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Taming the Bullwhip

Four critical methods for reducing the Bullwhip effect:

- Reduce uncertainty in the supply chain
  - Centralize demand information
  - Keep each stage of the supply chain provided with up-to-date customer demand information
  - More frequent planning (continuous real-time planning the goal)
- Reduce variability in the supply chain
  - Every-day-low-price strategies for stable demand patterns
- Reduce lead times
  - Use cross-docking to reduce order lead times
  - Use EDI techniques to reduce information lead times
- Eliminate the bullwhip through strategic partnerships
  - Vendor-managed inventory (VMI)
  - Collaborative planning, forecasting and replenishment (CPFR)

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Value of Information and SCM

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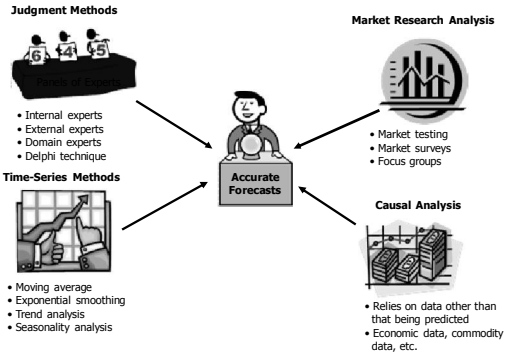
Methods for Improving Forecasts



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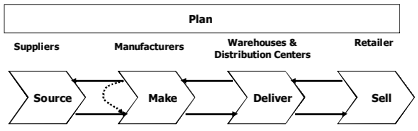
Information In The Supply Chain



Order Lead Time

Delivery Lead Time

Production Lead Time

- **Each facility further away from actual customer demand must make forecasts of demand**
- **Lacking actual customer buying data, each facility bases its forecasts on 'downstream' orders, which are more variable than actual demand**
- **To accommodate variability, inventory levels are overstocked thus increasing inventory carrying costs**

It's estimated that the typical pharmaceutical company supply chain carries over 100 days of product to accommodate uncertainty

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The Evolving Supply Chain

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Supply Chain Integration – Push Strategies

- Classical manufacturing supply chain strategy
- Manufacturing forecasts are long-range
  - Orders from retailers' warehouses
- Longer response time to react to marketplace changes
  - Unable to meet changing demand patterns
  - Supply chain inventory becomes obsolete as demand for certain products disappears
- Increased variability (Bullwhip effect) leading to:
  - Large inventory safety stocks
  - Larger and more variably sized production batches
  - Unacceptable service levels
  - Inventory obsolescence
- Inefficient use of production facilities (factories)
  - How is demand determined? Peak? Average?
  - How is transportation capacity determined?
- Examples: Auto industry, large appliances, others?

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Supply Chain Integration – Pull Strategies

- Production and distribution are demand-driven
  - Coordinated with true customer demand
- None or little inventory held
  - Only in response to specific orders
- Fast information flow mechanisms
  - POS data
- Decreased lead times
- Decreased retailer inventory
- Decreased variability in the supply chain and especially at manufacturers
- Decreased manufacturer inventory
- More efficient use of resources
- More difficult to take advantage of scale opportunities
- Examples: Dell, Amazon

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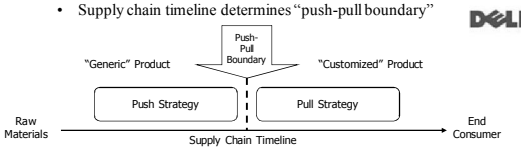
Supply Chain Integration – Push/Pull Strategies

- Hybrid of "push" and "pull" strategies to overcome disadvantages of each
- Early stages of product assembly are done in a "push" manner
  - Partial assembly of product based on aggregate demand forecasts (which are more accurate than individual product demand forecasts)
  - Uncertainty is reduced so safety stock inventory is lower
- Final product assembly is done based on customer demand for specific product configurations
- Supply chain timeline determines "push-pull boundary"



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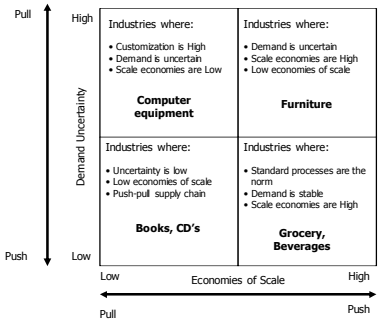
Choosing Between Push/Pull Strategies



Where do the following industries fit in this model:

- **Automobile?**
- **Aircraft?**
- **Fashion?**
- **Petroleum refining?**
- **Pharmaceuticals?**
- **Biotechnology?**
- **Medical Devices?**

Source: Simchi-Levi

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Characteristics of Push, Pull and Push/Pull Strategies

	PUSH	PULL
Objective	**Minimize Cost**	**Maximize Service Level**
Complexity	**High**	**Low**
Focus	**Resource Allocation**	**Responsiveness**
Lead Time	**Long**	**Short**
Processes	**Supply Chain Planning**	**Order Fulfillment**

Source: Simchi-Levi

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Supply Chain Collaboration – What Is It?

- Many different definitions depending on perspective
- The means by which companies within the supply chain work together towards mutual goals by sharing
  - Ideas
  - Information
  - Processes
  - Knowledge
  - Information
  - Risks
  - Rewards
- Why collaborate?
  - Accelerate entry into new markets
  - Changes the relationship between cost/value/profit equation

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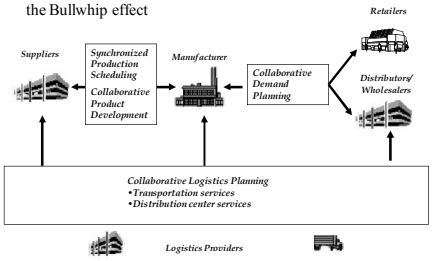
Supply Chain Collaboration

- Cornerstone of effective SCM
- The focus of many of today's SCM initiatives
- The only method that has the potential to eliminate or minimize the Bullwhip effect



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Benefits of Supply Chain Collaboration

CUSTOMERS	MATERIAL SUPPLIERS	SERVICE SUPPLIERS
• Reduced inventory • Increased revenue • Lower order management costs • Higher Gross Margin • Better forecast accuracy • Better allocation of promotional budgets	• Reduced inventory • Lower warehousing costs • Lower material acquisition costs • Fewer stockout conditions	• Lower freight costs • Faster and more reliable delivery • Lower capital costs • Reduced depreciation • Lower fixed costs
• Improved customer service • More efficient use of human resources		

Source: Cohen & Roussel

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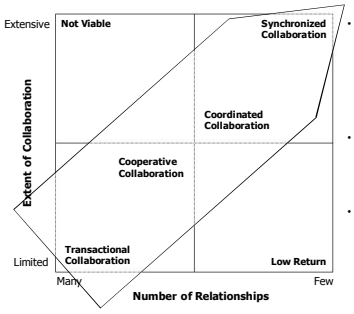

- **The green arrow describes increasing complexity and sophistication of:**
  - **Information systems**
  - **Systems infrastructure**
  - **Decision support systems**
  - **Planning mechanisms**
  - **Information sharing**
  - **Process understanding**
- **Higher levels of collaboration imply the need for both trading partners to have equivalent (or close) levels of supply chain maturity**
- **Synchronized collaboration demands joint planning, R&D and sharing of information and processing models**
  - **Movement to real-time customer demand information throughout the supply chain**

Source: Cohen & Roussel

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Successful Supply Chain Collaboration

- Try to collaborate internally before you try external collaboration
- Help your partners to work with you
- Share the savings
- Start small (a limited number of selected partners) and stay focused on what you want to achieve in the collaboration
- Advance your IT capabilities only to the level that you expect your partners to manage
- Put a comprehensive metrics program in place that allows you to monitor your partners' performance
- Make sure people are kept part of the equation
  - Systems do not replace people
  - Make sure your organization is populated with competent professionals who've done this before

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Emerging Best Practices in SCM Strategy

	Emerging Practices
Plan	• Expanding planning to include customers and suppliers with joint objective for customer service, flexibility, cycle times, and inventory • Setting up an end-customer pull-based planning approach (e.g., make-to-order)
Source	• Joint development and sharing the risks/benefits • Development of strategic supplier relationships • Automated/vendor-managed rapid replenishment of inventory to point of use and time of use
Make	• Postponement manufacturing (pull vs. push approach) • Design for supply chain/manufacturing
Deliver	• Centralized safety stock with rapid response to market demand/ inventory deployment • Ship direct to end-customer/single point of handling

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The SCOR Model

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Collaboration and the SCOR Model

- The Supply-Chain Council (SCC) is a global, not-for-profit trade association open to all types of organizations
  - 800 world-wide members
  - Multi-industry
- SCC sponsors and supports educational programs including conferences, retreats, benchmarking studies, and development of the Supply-Chain Operations Reference-model (SCOR), the process reference model designed to improve users' efficiency and productivity
- Promotes research and thought leadership in the supply chain management area
- Adoption of common standards for reference to process, information and material goods flows is essential to enable trading partner collaboration

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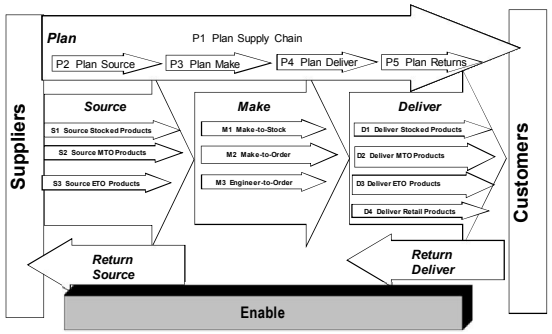
SCOR 7.0 Model Structure



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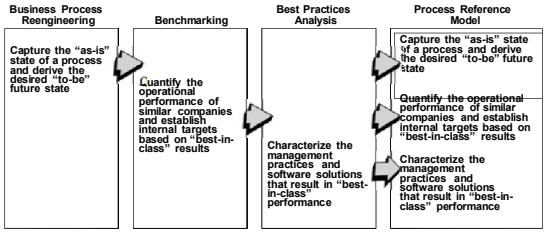
Process Reference Models

- Process reference models integrate the well-known concepts of business process reengineering, benchmarking, and process measurement into a cross-functional framework



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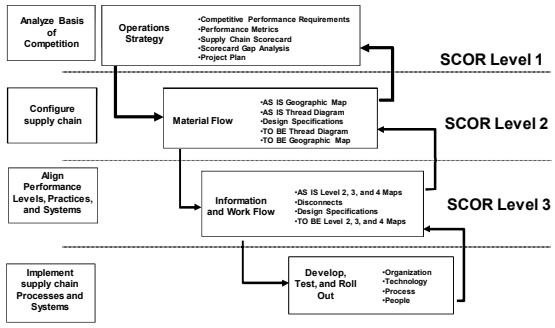
SCOR Implementation Roadmap



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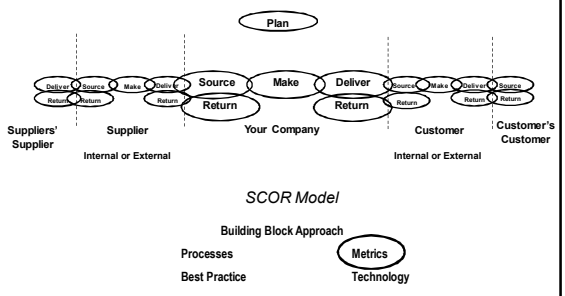
SCOR Structure



SCOR Model

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Examples of SCOR Adoptions

- **Consumer Foods**
  - Project Time (Start to Finish) – 3 months
  - Investment - $50,000
  - 1st Year Return - $4,300,000
- **Electronics**
  - Project Time (Start to Finish) – 6 months
  - Investment - $3-5 Million
  - Projected Return on Investment - $ 230 Million
- **Software and Planning**
  - SAP bases APO key performance indicators (KPIs) on SCOR Model
- **Aerospace and Defense**
  - SCOR Benchmarking and use of SCOR metrics to specify performance criteria and provide basis for contracts / purchase orders

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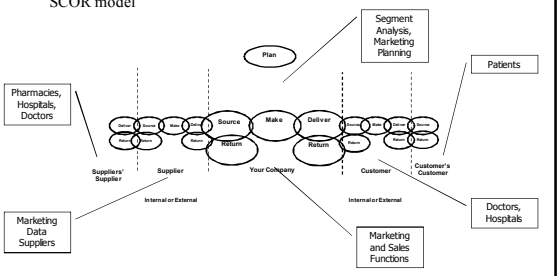
The SCOR Model As Context for This Course

- Pharmaceutical sales and marketing activities have their own set of logistics related activities that can be fully described using the SCOR model



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The SCOR Model As Context for This Course

- Two interrelated "supply chains" work together to deliver drugs to market:
  - The Marketing and Sales "supply chain" which is principally information-based
  - The Logistics supply chain which is principally product-based