

Introduction to Supply Chain Management

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- 1 Introduction to Supply Chain
- 2 Supply Chain Performance
- 3 Introduction to Data Objects

What is a Supply Chain?

- A **supply chain** includes all parties involved, directly or indirectly, in fulfilling a customer request.
- It consists of manufacturers, suppliers, transporters, warehouses, retailers, and customers.
- **Key Functions:**
 - New product development
 - Marketing
 - Operations
 - Distribution
 - Finance
 - Customer service

Supply Chain Example – Walmart

Customer's Need: Detergent purchase at a Walmart store.

- **Supply Chain Flow:**

- ① **Customer** visits Walmart store.
- ② **Walmart** stocks inventory from a warehouse or distributor.
- ③ **Distributor** is supplied by the manufacturer (e.g., Procter & Gamble).
- ④ **Manufacturer** receives raw materials from various suppliers.
- ⑤ Suppliers may source materials from lower-tier suppliers.

Stages of a Detergent Supply Chain

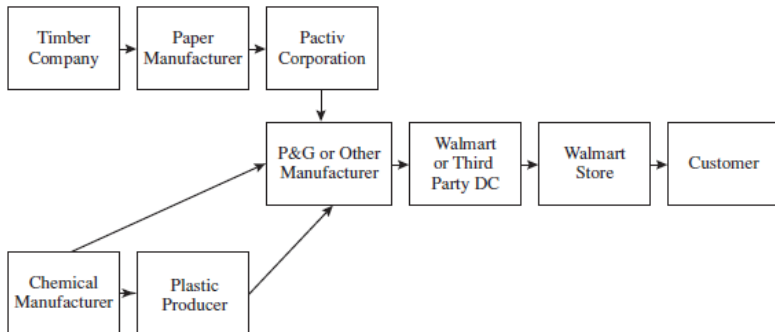


Figure: Detergent Supply Chain

Dynamic Nature of Supply Chains

- Supply chains involve a **constant flow of information, products, and funds.**
- **Example:**
 - **Walmart** provides product, pricing, and availability info to the customer.
 - Customer pays Walmart and receives the product.
 - Walmart sends **point-of-sale data** and **replenishment orders** to distributors.
 - Distributors deliver stock and send pricing info to Walmart.
 - **Recycling:** Walmart may return packaging material for recycling.

Supply Chain Example – Amazon

Customer purchases a product from **Amazon's website**.

- The supply chain includes:
 - 1 Customer
 - 2 Amazon's website
 - 3 Amazon's warehouse
 - 4 Amazon's suppliers and their suppliers
- The **website** provides info on pricing, product variety, and availability.
- **Order Process:**
 - Customer places an order and makes a payment.
 - Customer can check order status online.
 - Supply chain stages use the **order information** to fulfill the request.

Importance of the Customer in the Supply Chain

- The **customer** is a key part of the supply chain.
- **Primary Purpose:**
 - To satisfy customer needs.
 - To generate profit for all supply chain participants.
- **Flows in a Supply Chain:**
 - Product flow
 - Information flow
 - Fund flow
- Supply chains are better visualized as **networks** or **webs**, not linear chains.

Supply Chain Stages

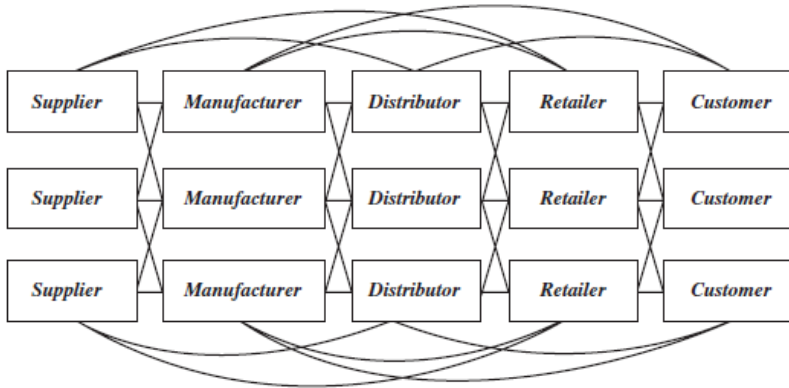


Figure: Supply Chain Stages

Stages in a Typical Supply Chain

- A typical supply chain may involve the following stages:
 - Customers
 - Retailers
 - Wholesalers/Distributors
 - Manufacturers
 - Component/Raw Material Suppliers
- Each stage is connected through the flow of products, information, and funds.
- These flows occur in both directions and may be managed by one of the stages or an intermediary.

Supply Chain Design – Dell Example

- The design of a supply chain depends on the customer's needs and the roles played by the stages involved.
- **Dell's Two Supply Chain Structures:**
 - For **server business**: Dell builds to order. Customer orders initiate manufacturing at Dell. No retailer, distributor, or wholesaler is involved.
 - For **consumer products** like PCs and tablets: Dell sells through retailers like Walmart, which carry Dell products in inventory. This supply chain has an extra stage (retailer).
- In other retail scenarios, a wholesaler or distributor may also be part of the supply chain.

Objective of a Supply Chain

- The objective of every supply chain is to maximize the overall value generated.
- $\text{Value (Supply Chain Surplus)} = \text{Customer Value} - \text{Supply Chain Cost}.$
- It is the difference between what the value of the final product is to the customer and the costs incurred to fill the customer's request.

Understanding Supply Chain Surplus

- Supply Chain Surplus is the difference between the revenue generated from the customer and the overall cost across the supply chain.
- Example: A customer purchasing a wireless router from Best Buy pays \$60.
- The difference between the \$60 and the costs incurred by the supply chain stages represents the supply chain profitability.

Importance of Supply Chain Profitability

- The higher the supply chain profitability, the more successful the supply chain.
- For most profit-making supply chains, the supply chain surplus is strongly correlated with profits.
- Supply chain success should be measured in terms of supply chain surplus and not in terms of profits at an individual stage.

Sources of Value, Revenue, and Cost

- The only source of revenue for a supply chain is the customer.
- The value obtained by a customer depends on factors like product functionality, travel distance, and product availability.
- Effective supply chain management involves managing assets and flows to grow the total supply chain surplus.

Analyzing Supply Chain Decisions

- Decisions impact supply chain surplus and vary for different reasons.
- Example: Difference in supply chain structure between fast-moving consumer goods in the U.S. and India.
- U.S. distributors play a smaller role, whereas Indian distributors play a crucial role due to the large number of small retail outlets.

Role of Distributors in India

- Indian retail outlets require frequent replenishment due to their small size.
- Distributors help reduce transportation costs by receiving full truckloads and making smaller deliveries to retailers.
- Distributors in India also handle collections, reducing overall costs.

Conclusion

- Supply chain surplus drives overall success.
- Effective management of supply chain assets and flows is key to increasing surplus.
- Distributors play a varying role in different markets, impacting supply chain structure and profitability.

Importance of Supply Chain Decisions

- Supply chain design and management are crucial for business success.
- Examples of successful companies: Walmart, Amazon, Seven-Eleven Japan.
- Examples of failures: Webvan, Borders.

Walmart's Success

- Walmart invested in transportation and information infrastructure.
- Designed clusters of stores around distribution centers for frequent replenishment.
- Collaborated with suppliers to reduce costs and improve product availability.
- In 2013, Walmart reported a net income of \$17 billion on revenues of \$469 billion.
- In 1980s, the company reached annual sales of only \$ 1 Billion in 1980.
- The growth in sales represents an annual compounded growth rate of more than 20 percent

Seven-Eleven Japan's Success

- Used a responsive replenishment system and outstanding information system.
- Ensured products were available when and where customers needed them.
- Changed merchandising mix at stores by time of day to match customer demand.
- Grew from 1 billion yen in 1974 to 1.9 trillion yen in 2013, with 222 billion yen profit.

Failure of Webvan

- Webvan designed a supply chain with large warehouses and home delivery.
- Traditional supermarkets had lower transportation costs and higher inventory turns.
- Webvan's high transportation and labor costs led to its failure in 2001.

Borders' Failure

- Borders implemented the superstore concept, offering greater variety at lower costs.
- Amazon's online model provided even greater variety at lower costs.
- Borders failed to adapt its supply chain to compete with Amazon.
- By 2009, Borders' sales dropped to *2.8 billion*, and it lost 109 million.

Dell's Success and Adaptation

- Dell achieved success by selling directly to customers and centralizing manufacturing.
- Provided customized PCs quickly and at reasonable cost.
- As customer needs shifted to lower customization, Dell adapted its supply chain.
- Started selling PCs through retail chains and outsourced assembly to low-cost locations.

Key Point

- Supply chain decisions significantly impact a firm's success or failure.
- Supply chains must adapt to changing technology and customer expectations.
- Effective supply chain management ensures competitiveness in the market.

Importance of a Supply Chain

- Successful supply chains require appropriate design, planning, and operation.
- Companies must continuously adapt their supply chains to remain competitive.
- Supply chain decisions are categorized based on their frequency and time frame.

Introduction to Decision Phases

- Successful supply chain management requires decisions about the flow of information, products, and funds.
- Each decision aims to raise the supply chain surplus.
- Decisions are categorized into three phases:
 - 1 Supply Chain Strategy or Design
 - 2 Supply Chain Planning
 - 3 Supply Chain Operation

Phase 1: Supply Chain Strategy or Design

- Focuses on the structure of the supply chain over several years.
- Determines the configuration, allocation of resources, and processes performed at each stage.
- Key decisions include:
 - Outsourcing vs. in-house functions
 - Location and capacities of facilities
 - Products manufactured or stored at various locations
 - Transportation modes and information systems
- Example: PepsiCo's acquisition of two major bottlers to streamline its supply chain.

Supply Chain Strategy - Contd

- Supply chain design decisions are typically made for the long term
- They are expensive to alter in shorter notice
- When Companies make decision, Consider
 - ① Uncertainty in anticipated market conditions over the following few years.

Phase 2: Supply Chain Planning

- Time frame: A quarter to a year.
- The configuration established in the design phase is fixed.
- The goal is to maximize the supply chain surplus within set constraints.
- Involves decisions on:
 - Market supply from different locations
 - Subcontracting of manufacturing
 - Inventory policies
 - Timing and size of marketing promotions
- Example: ArcelorMittal's production and market decisions.

Supply Chain Planning - contd

- In Planning face, companies must include uncertainty in demand, exchange rates, and competition over this time horizon.
- Given a shorter time frame and better forecasts than in the design phase, companies try to
 - 1 Incorporate any flexibility built into the supply chain in the design phase
 - 2 Exploit to optimize performance

Phase 3: Supply Chain Operation

- Time horizon: Weekly or daily.
- Decisions relate to individual customer orders.
- Focuses on handling orders in the best possible manner.
- Key activities:
 - Inventory or production allocation
 - Order fulfillment dates
 - Warehouse pick lists
 - Shipping modes and schedules
 - Replenishment orders
- Less uncertainty about demand information.
- **Goal:** Exploit the reduction of uncertainty and optimize the performance.

Key Point

Key Insight

Supply chain decision phases may be categorized as design, planning, or operational, depending on the time frame during which the decisions apply.

- Design decisions constrain or enable effective planning.
- Planning decisions constrain or enable effective operation.
- Effective supply chain management ensures profitability and success.

Significance of Decision Phases

- Supply chain decisions significantly impact overall profitability.
- Companies like Walmart and Seven-Eleven Japan showcase effective supply chain management.
- Future discussions will address methodologies for each decision phase.

Process Views of a Supply Chain

- A supply chain is a sequence of processes and flows within and between different stages to fill a customer need for a product.
- Two ways to view supply chain processes:
 - Cycle View
 - Push/Pull View

Cycle View of Supply Chain Processes

- Processes are divided into a series of cycles performed at the interface between two successive stages.
- Four process cycles:
 - Customer Order Cycle
 - Replenishment Cycle
 - Manufacturing Cycle
 - Procurement Cycle

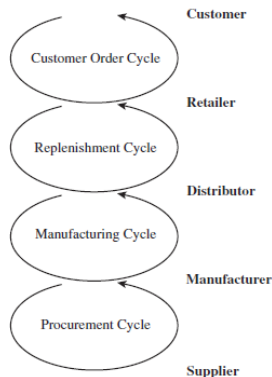


Figure: Supply Chain Process Cycles

Cycle View - Example

- Not every supply chain has all four cycles clearly separated.
- Example:
 - A grocery supply chain has all four cycles.
 - Dell bypasses the retailer and distributor when selling servers directly to customers.

Subprocesses in Each Cycle

- Each cycle consists of six subprocesses:
 - Supplier markets the product.
 - Buyer places an order.
 - Supplier receives the order.
 - Supplier supplies the order.
 - Buyer receives the order.
 - Buyer may return product or recycled material.
- Subprocesses align with the SCOR model (Source, Make, Deliver, Return).

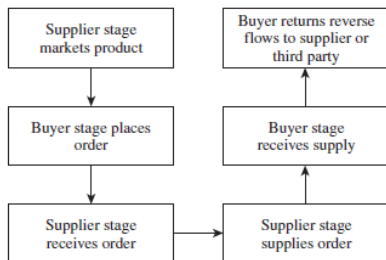


Figure: Subprocesses in each supply chain process cycle

Application of Cycles

- Depending on the transaction, subprocesses apply to appropriate cycles.
- Example:
 - Customers shopping on Amazon are part of the Customer Order Cycle.
 - Amazon ordering books from distributors is part of the Replenishment Cycle.

Key Goals within Each Cycle

- Buyer's goal: Ensure product availability and achieve economies of scale.
- Supplier's goal: Forecast orders, reduce costs, fill orders on time, and manage reverse flows.

Differences Across Cycles

- In the Customer Order Cycle, demand is external and uncertain.
- In other cycles, order placement can be projected based on policies.
- Order scale:
 - Single customer order vs. multiple large orders as we move upstream.

Importance of Cycle View

- Useful for operational decisions by clearly defining roles and responsibilities.
- ERP systems use the cycle view to support supply chain operations.
- Sharing of information and policies across stages is critical.

Key Point

- A cycle view of the supply chain clearly defines the processes involved and their owners.
- This view helps in understanding roles, responsibilities, and desired outcomes for each process.

Push/Pull View of Supply Chain Processes

All processes in a supply chain fall into one of two categories, depending on the timing of their execution relative to end customer demand.

- **Pull processes:** Execution is initiated in response to a customer order.
- **Push processes:** Execution is initiated in anticipation of customer orders based on a forecast.

Pull processes may also be referred to as reactive, while push processes are speculative.

Push/Pull Boundary

The push/pull boundary in a supply chain separates push processes from pull processes, as shown in the figure below.

- Push processes operate in an uncertain environment as customer demand is not yet known.
- Pull processes operate in an environment where customer demand is known, but may be constrained by inventory and capacity decisions made in the push phase.

Push/Pull View of the Supply Chain

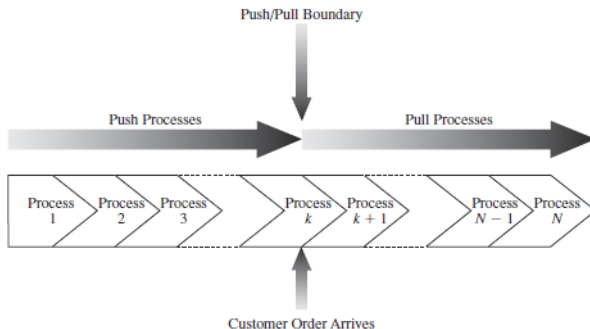


Figure: Push / Pull View of the Supply Chain

L.L. Bean Example: Make-to-Stock vs Build-to-Order

L.L. Bean operates in a make-to-stock environment where:

- **Pull processes:** All processes in the customer order cycle after the customer order arrives.
- **Push processes:** Replenishment cycle processes are performed in anticipation of demand.

Raw materials like fabric are purchased 6 to 9 months in advance, and manufacturing begins months before the point of sale.

LL Bean Example

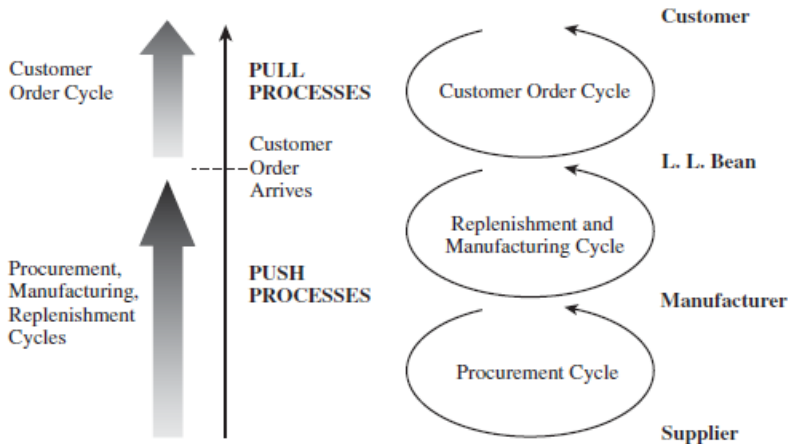


Figure: Push/Pull Processes of the LL Bean Supply Chain

Ethan Allen Example: Customized Furniture

Ethan Allen's supply chain for customized furniture (e.g., sofas and chairs) includes:

- **Pull processes:** All processes in the customer order and manufacturing cycle are triggered by customer orders.
- **Push processes:** Procurement processes are performed in anticipation of customer demand.

Push/Pull Process for Ethan Allen Supply Chain for Customized Furniture

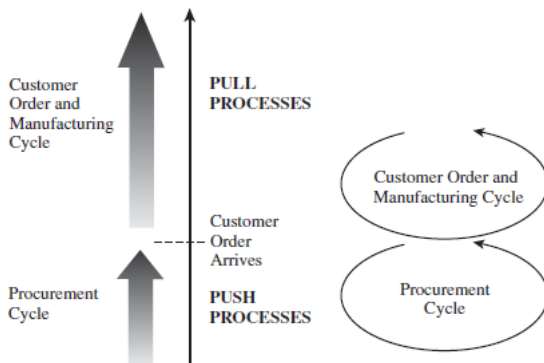


Figure: Push/Pull processes of Ethan Allen Supply Chain for Customized Furniture

Key Point

A push/pull view of the supply chain categorizes processes based on:

- **Pull processes:** Initiated in response to a customer order.
- **Push processes:** Initiated in anticipation of a customer order (based on forecast).

This view is crucial for making strategic decisions about supply chain design, aiming to match supply and demand effectively.

Example: Paint Industry

The paint industry demonstrates the benefits of adjusting the push/pull boundary:

- Initially, mixing of colors was done in large factories, qualifying as **push processes**.
- In the 1990s, color mixing was shifted to retail stores after customer orders, turning it into a **pull process**.

Supply Chain

- The push/pull view helps in understanding how processes are aligned with customer demand, thus aiding in the design of more efficient supply chains.
- By identifying the right push/pull boundary, companies can improve demand matching and reduce inefficiencies.

Supply Chain Macro Processes

All supply chain processes can be classified into the following three macro processes:

- **Customer Relationship Management (CRM):** All processes at the interface between the firm and its customers.
- **Internal Supply Chain Management (ISCM):** All processes that are internal to the firm.
- **Supplier Relationship Management (SRM):** All processes at the interface between the firm and its suppliers.

Supply Chain Macro Processes



Figure: Macro Processes in Supply Chain

Key Point

Within a firm, all supply chain activities belong to one of three macro processes:

- CRM
- ISCM
- SRM

Integration among the three macro processes is crucial for successful supply chain management.

Customer Relationship Management (CRM)

The CRM macro process aims to generate customer demand and facilitate the placement and tracking of orders. It includes processes such as:

- Marketing
- Pricing
- Sales
- Order Management
- Call Center Management

Example: In W.W. Grainger, CRM processes include catalog preparation, website management, and managing the call center for orders and service.

Internal Supply Chain Management (ISCM)

The ISCM macro process aims to fulfill demand generated by the CRM process in a timely manner and at the lowest possible cost. It includes processes such as:

- Planning of internal production and storage capacity
- Preparation of demand and supply plans
- Fulfillment of actual orders

Example: In W.W. Grainger, ISCM processes include warehouse location planning, inventory management, and order fulfillment.

Supplier Relationship Management (SRM)

The SRM macro process arranges for and manages supply sources for various goods and services. It includes processes such as:

- Evaluation and selection of suppliers
- Negotiation of supply terms
- Communication regarding new products and orders with suppliers

Example: In W.W. Grainger, SRM processes include supplier selection, pricing negotiations, sharing demand plans, and placing replenishment orders.

Integration of Macro Processes

- All three macro processes aim to serve the same customer.
- Integration among CRM, ISCM, and SRM is crucial for a successful supply chain.
- Lack of integration can lead to mismatches between supply and demand, resulting in customer dissatisfaction and high costs.

For example, marketing and manufacturing often have different forecasts, which harms supply chain performance.

Organizational Structure and Integration

- Marketing typically handles CRM, manufacturing manages ISCM, and purchasing oversees SRM.
- These departments often have little communication, leading to misaligned forecasts.
- A successful supply chain requires good communication and coordination among the owners of each macro process.

Firms should structure their supply chain organization to mirror the macro processes and ensure effective integration.

Introduction - Supply Chain Performance

- A company's competitive strategy defines the set of customer needs it seeks to satisfy through its products and services.
- Supply chain strategy involves procurement, production, distribution, and service functions to fulfill competitive strategy.

Example: Walmart

- Walmart's competitive strategy focuses on low prices and high product availability.
- Offers a wide variety of commonplace products at reasonable quality.
- Emphasis on cost over product variety or responsiveness.

Example: McMaster-Carr

- Sells over 500,000 maintenance, repair, and operations (MRO) products through catalog and website.
- Competitive strategy focuses on convenience, availability, and responsiveness.
- Does not compete on low price.

Example: Blue Nile vs Zales

- **Blue Nile:** Online diamond retailer focusing on variety and cost.
- **Zales:** Brick-and-mortar store focusing on fast response time and in-person service.
- Different customer priorities lead to different competitive strategies.

Customer Priorities and Competitive Strategy

- Competitive strategy is based on customer priorities such as:
 - Product Cost
 - Delivery Time
 - Variety
 - Quality
- Examples:
 - Walmart focuses on low cost.
 - McMaster-Carr focuses on variety and response time.

Value Chain

- New Product Development: Creates product specifications.
- Marketing and Sales: Generates demand and gathers customer input.
- Operations: Transforms inputs into outputs.
- Distribution: Delivers product to customers.
- Service: Handles customer requests during/after sale.

Functional Strategies

- **Product Development Strategy:** Specifies new product portfolio.
- **Marketing and Sales Strategy:** Segments market and positions product.
- **Supply Chain Strategy:** Determines procurement, production, and distribution.

Supply Chain Strategy Examples

- **Dell:** Initially sold directly to customers, later included resellers.
- **Cisco:** Uses contract manufacturers.
- **Amazon:** Built warehouses and uses distributors.

Importance of Alignment

- Functional strategies must support competitive strategy.
- Example: Seven-Eleven Japan's success through alignment of marketing, operations, and distribution strategies.
- Alignment creates a virtuous cycle improving supply chain performance.

Performance

- Competitive strategy defines how a company satisfies customer needs.
- Supply chain strategy ensures efficient procurement, production, and distribution.
- Alignment between strategies is key to organizational success.

Value Chain in a Company

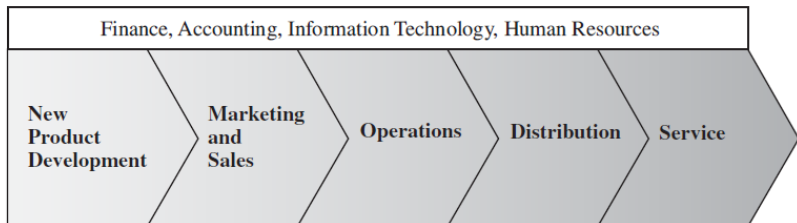


Figure: Value chain in a Company

Introduction to Strategic Fit

- Strategic fit ensures that a company's competitive and supply chain strategies have aligned goals.
- It requires consistency between customer priorities and supply chain capabilities.
- Achieving strategic fit involves aligning all functional strategies with the overall competitive strategy.

Requirements for Achieving Strategic Fit

- 1 The competitive strategy and all functional strategies must form a coordinated overall strategy.
- 2 Functions must structure processes and resources to execute these strategies successfully.
- 3 The overall supply chain design and roles of each stage must align with the supply chain strategy.

Consequences of Lack of Strategic Fit

- A company may fail due to a lack of strategic fit.
- Misalignment between marketing and distribution strategies can result in delayed orders and unhappy customers.
- Supplier selection and inventory management must align with customer priorities to ensure satisfaction.

Case Study: Dell's Evolution

- Between 1993-2006, Dell focused on customization and built a responsive supply chain.
- Starting in 2007, Dell shifted its competitive strategy towards low prices and adjusted its supply chain accordingly.
- Contract manufacturers like Foxconn produce many of Dell's products to support the build-to-stock model.

Steps to Achieve Strategic Fit

- ① Understanding the Customer and Supply Chain Uncertainty
- ② Understanding the Supply Chain Capabilities
- ③ Achieving Strategic Fit

Step 1: Understanding Customer Needs

- Identify customer needs for each targeted segment.
- Different segments have varying needs in terms of product quantity, response time, variety, service level, and price.
- Implied demand uncertainty reflects the uncertainty the supply chain must address.

Step 2: Understanding Supply Chain Capabilities

- Different supply chains are designed to perform different tasks well.
- A company must understand what its supply chain is designed to do effectively.
- Align supply chain capabilities with customer needs to reduce uncertainty.

Step 3: Achieving Strategic Fit

- Restructure the supply chain to support the competitive strategy if a mismatch exists.
- Adjust the competitive strategy to align with the supply chain's capabilities.
- Ensure all functions within the company are aligned to achieve strategic fit.

Understanding Implied Demand Uncertainty

- Implied demand uncertainty measures the uncertainty imposed on the supply chain due to customer needs.
- It is distinct from general demand uncertainty.
- Higher service levels increase implied demand uncertainty.

Impact of Customer Needs on Implied Demand Uncertainty

Table: Impact of Customer Needs on Implied Demand Uncertainty

Customer Need	Causes Implied Demand Uncertainty to...
Range of quantity required increases	Increase because a wider range of the quantity required implies greater variance in demand.
Lead time decreases	Increase because there is less time in which to react to orders.
Variety of products required increases	Increase because demand per product becomes less predictable.
Number of channels through which product may be acquired increases	Increase because customer demand per channel becomes less predictable.
Rate of innovation increases	Increase because new products tend to have more uncertain demand.
Required service level increases	Increase because the firm now has to handle unusual surges in demand.

Data Objects and Attributes

- Data sets consist of data objects.
- A data object represents an entity (e.g., customers, patients, students).
- Data objects are described by attributes.
- Data objects can also be called samples, examples, instances, data points, or tuples.

What is an Attribute?

- An attribute is a data field representing a characteristic of a data object.
- Attributes are also known as dimensions, features, or variables.
- Example: A customer object can have attributes like ID, name, and address.
- Observed values of attributes are called observations.

Nominal Attributes

- Nominal means “relating to names.”
- Values represent categories or states.
- Examples: Hair color (black, brown, blond), Marital status (single, married).
- Values may be represented by numbers, but mathematical operations are not meaningful.
- The mode is a common measure of central tendency for nominal attributes.

Binary Attributes

- A binary attribute has two categories or states (0 or 1).
- It is referred to as Boolean if states correspond to true and false.
- Symmetric binary attributes: Both states are equally important (e.g., gender).
- Asymmetric binary attributes: States have different importance (e.g., medical test outcomes).

Ordinal Attributes

- Values have a meaningful order or ranking.
- Magnitude between successive values is not known.
- Examples: Drink size (small, medium, large), Grades (A, B, C).
- Central tendency measures include mode and median.

Numeric Attributes

- Numeric attributes provide quantitative measurements.
- Two types: Interval-scaled and Ratio-scaled.
- Interval-scaled: Equal-sized units (e.g., temperature in Celsius).
- Ratio-scaled: Has a true zero-point (e.g., weight, height).

Discrete vs. Continuous Attributes

- Discrete attributes: Finite or countably infinite set of values.
- Continuous attributes: Represent measurable quantities (e.g., real numbers).
- Discrete examples: Hair color, medical test results.
- Continuous examples: Temperature, weight.