

Supply Chain Management

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MGM 660

Lecture 3



Supply Chain Drivers and Metrics

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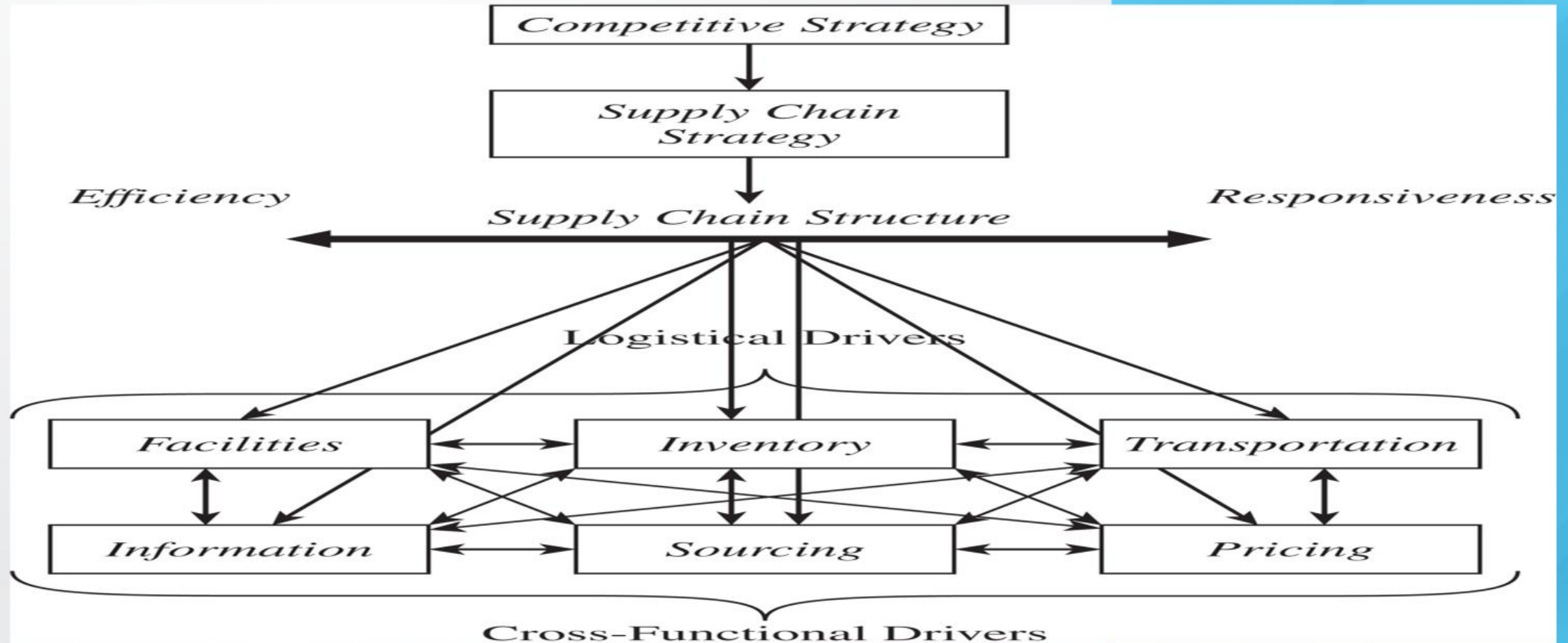
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Course Agenda

Chapter 01

- 1- Identify the major drivers of supply chain performance.
- 2- Discuss the role of each driver in creating a strategic fit between the supply chain strategy and the competitive strategy.
- 3- Define the key metrics that track the performance of the supply chain in terms of each driver.

Framework for Structuring Drivers



A trade-off in supply chain management is the balance between two competing objectives, where improving one objective may worsen another.

Common Supply Chain Trade-Offs

1. Responsiveness vs. Efficiency

- **Responsiveness:** Ability to react quickly to customer demand.
- **Efficiency:** Ability to operate at low cost.

Example: Holding large inventories improves responsiveness but increases costs.

2. Inventory vs. Transportation

- Keeping more inventory in multiple locations reduces delivery time.
- However, it increases inventory holding costs.
- Keeping less inventory lowers inventory costs but may require more expensive transportation.

3. Transportation Cost vs. Delivery Speed

- Air freight is fast but expensive.
- Sea freight is cheaper but slower.

4. Facilities Cost vs. Customer Service

- More warehouses improve customer service and reduce delivery times.
- Fewer warehouses reduce facility costs but may increase delivery times.

Example

A company can:

- **Store products in many warehouses** → Faster delivery, higher costs.
- **Store products in one central warehouse** → Lower costs, slower delivery.

Thus, supply chain managers must choose the right balance between **cost efficiency** and **customer responsiveness** to achieve the company's competitive strategy.

The trade-offs within each driver

Driver	More Responsive	More Efficient
Facilities	Multiple Plants Flexible Plants	Single Plant Dedicated Plant
Inventory	Higher Inventory	Lower Inventory
Transportation	Higher Speed	Lower Speed
Information	Accurate Real Time Transmission	Less Accurate Batched Transmission
Sourcing	Responsive supplier	Efficient supplier
Pricing	Differential Pricing	Everyday Low Pricing

Supply Chain Drivers are the key factors that determine the performance of a supply chain in terms of responsiveness and efficiency.

The structural (or logistical) supply chain drivers are:

Facilities – The physical locations where products are manufactured, assembled, stored, or sold (such as factories, warehouses, and distribution centers).

Inventory – All raw materials, work-in-process items, and finished goods held throughout the supply chain.

Transportation – The movement of products between different stages of the supply chain, including shipping by truck, rail, air, sea, or pipeline.

These drivers are called **structural drivers** because they involve the physical design and operation of the supply chain network.

In many supply chain frameworks, the other drivers are Information, Sourcing, and Pricing, which are often referred to as cross-functional drivers.

4. Information

- Data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain

5. Sourcing

- Who will perform a particular supply chain activity?

6. Pricing

- How much a firm will charge for the goods and services that it makes available in the supply chain

Structural (Logistical) Drivers: Facilities, Inventory, Transportation.

Cross-Functional Drivers: Information, Sourcing, Pricing.

- **Role in the supply chain**

- Increase responsiveness by increasing the number of facilities, making them more flexible, or increasing capacity.
- **For example,**
- **Amazon** increased the number of warehousing facilities located close to customers to improve its responsiveness.
- In contrast, **Best Buy** tried to improve its efficiency by shutting down retail facilities even though it reduced responsiveness.

- **Role in the supply chain**

- **Tradeoffs** between facility, inventory, and transportation costs.
 - Increasing the number of facilities increases facility and inventory costs, decreases transportation costs and reduces response time
 - Increasing the flexibility or capacity of a facility increases facility costs but decreases inventory costs and response time.
- **For example, IKEA** has become profitable by opening a few hundred large stores (no more than one or two per city) to grow efficiency,
- **Seven- Eleven Japan** has grown profitability by opening a highly dense network of stores (often hundreds per city) to provide responsiveness.
- **Both companies** are successful because the facility decisions are aligned with the supply chain strategy.

- **Components of facilities decisions**
 - **Capacity**
 - A facility's capacity to perform its intended function or functions
 - Excess capacity – responsive, costly
 - Little excess capacity – more efficient, less responsive

Components of facilities decisions

Facility-related metrics

- **Capacity** (measures the maximum amount a facility can process).
- **Utilization** (measures the fraction of capacity that is currently being used in the facility).
- **Processing/setup/down/idle time** (measures the fraction of time that the facility was processing units, being set up to process units, unavailable because it was down, or idle because it had no units to process).
- **Production cost per unit** (measures the average cost to produce a unit of output)
- **Quality losses** (measure the fraction of production lost as a result of defects)
- **Theoretical flow/cycle time of production** (measures the time required to process a unit if there are absolutely no delays at any stage)
- **Actual average flow/cycle time** (measures the average actual time taken for all units processed over a specified duration, such as a week or a month).

Components of facilities decisions

Facility-related metrics

- **Flow time efficiency** (is the ratio of the theoretical flow time to the actual average flow time. Low values for flow time efficiency indicate that a large fraction of time is spent waiting).
- **Product variety** (measures the number of products or product families processed in a facility)
- **Volume contribution of top 20 percent SKU's and customers** (measures the fraction of total volume processed by a facility that comes from the top 20 percent of SKUs or customers).
- **Average production batch size** (measures the average amount produced in each production batch)
- **Production service level** (measures the fraction of production orders completed on time and in full.

- **Role in the Supply Chain**

- Mismatch between supply and demand
- Exploit economies of scale
- Reduce costs
- Improve product availability
- Affects assets, costs, responsiveness, material flow time

- **Overall trade-off**
 - Increasing inventory generally makes the supply chain more responsive
 - A higher level of inventory facilitates a reduction in production and transportation costs because of improved economies of scale
 - Inventory holding costs increase

- **Cycle inventory**

- Average amount of inventory used to satisfy demand between supplier shipments
- Function of lot size decisions

- **Safety inventory**

- Inventory held in case demand exceeds expectations
- Costs of carrying too much inventory versus cost of losing sales

- **Seasonal inventory**
 - Inventory built up to counter predictable variability in demand.
 - Cost of carrying additional inventory versus cost of flexible production.
- **Level of product availability**
 - The fraction of demand that is served on time from product held in inventory.
 - Trade off between customer service and cost.

- **Inventory-related metrics**
 - **C2C cycle time** (is a high-level metric that includes inventories, accounts payable, and receivables).
 - **Average inventory** (measures the average amount of inventory carried. Average inventory should be measured in units, days of demand, and financial value)
 - **Inventory turns** (measure the number of times inventory turns over in a year)
 - **Products with more than a specified number of days of inventory** (identifies the products for which the firm is carrying a high level of inventory)
 - **Average replenishment batch size** (measures the average amount in each replenishment order. The batch size should be measured by SKU in terms of both units and days of demand)

- **Role in the Supply Chain**
 - Moves the product between stages in the supply chain
 - Affects responsiveness and efficiency
 - Faster transportation allows greater responsiveness but lower efficiency
 - Also affects inventory and facilities
 - Allows a firm to adjust the location of its facilities and inventory to find the right balance between responsiveness and efficiency

- **Components of Transportation Decisions**

- **Design of transportation network**

- Modes, locations, and routes
- Direct or with intermediate consolidation points
- One or multiple supply or demand points in a single run

- **Components of Transportation Decisions**

- **Choice of transportation mode**

- Air, truck, rail, sea, and pipeline
- Information goods via the Internet
- Different speed, size of shipments, cost of shipping, and flexibility

– Transportation-related metrics

- **Average inbound transportation cost** (typically measures the cost of bringing product into a facility)
- **Average income shipment size** (measures the average number of units or dollars in each incoming shipment at a facility)
- **Average inbound transportation cost per shipment** (measures the average transportation cost of each incoming delivery).
- **Average outbound transportation cost** (measures the cost of sending product out of a facility to the customer)
- **Average outbound shipment size** (measures the average number of units or dollars on each outbound shipment at a facility)
- **Average outbound transportation cost per shipment** (measures the average transportation cost of each outgoing delivery)
- **Fraction transported by mode** (measures the fraction of transportation (in units or dollars) using each mode of transportation)

- **Overall trade-off: Responsiveness versus efficiency**
 - The cost of transporting a given product (efficiency) and the speed with which that product is transported (responsiveness)
 - Using fast modes of transport raises responsiveness and transportation cost but lowers the inventory holding cost

- **Role in the Supply Chain**

- Improve the utilization of supply chain assets and the coordination of supply chain flows to increase responsiveness and reduce cost
- Information is a key driver that can be used to provide higher responsiveness while simultaneously improving efficiency

- **Role in the Competitive Strategy**

- Improves visibility of transactions and coordination of decisions across the supply chain
- Right information can help a supply chain better meet customer needs at lower cost
- More information increases complexity and cost of both infrastructure and analysis exponentially while marginal value diminishes
- Share the minimum amount of information required to achieve coordination

- **Overall trade-off: Responsiveness versus efficiency**
 - The cost of transporting a given product (efficiency) and the speed with which that product is transported (responsiveness)
 - Using fast modes of transport raises responsiveness and transportation cost but lowers the inventory holding cost

- **Push versus Pull**
 - Different information requirements and uses
- **Coordination and information sharing**
 - Supply chain coordination, all stages of a supply chain work toward the objective of maximizing total supply chain profitability based on shared information
- **Sales and operations planning (S&OP)**
 - The process of creating an overall supply plan (production and inventories) to meet the anticipated level of demand (sales)

- **Enabling technologies**

1. Electronic data interchange (EDI)
2. The Internet
3. Enterprise resource planning (ERP) systems
4. Supply chain management (SCM) software
5. Radio frequency identification (RFID)

- **Information-related metrics**
 - **Forecast horizon** (identifies how far in advance of the actual event a forecast is made)
 - **Frequency of update** (identifies how frequently each forecast is updated)
 - **Forecast error** (measures the difference between the forecast and actual demand)
 - **Seasonal factors** (measure the extent to which the average demand in a season is above or below the average in the year)
 - **Variance from plan** (identifies the difference between the planned production/inventories and the actual values)
 - **Ratio of demand variability to order variability** (measures the standard deviation of incoming demand and supply orders placed)

- **Role in the Supply Chain**

- Set of business processes required to purchase goods and services
- Will tasks be performed by a source internal to the company or a third party
- Increase the size of the total surplus to be shared across the supply chain

- **Role in the Competitive Strategy**

- Sourcing decisions are crucial because they affect the level of efficiency and responsiveness in a supply chain
- Outsource to responsive third parties if it is too expensive to develop their own
- Keep responsive process in-house to maintain control

- **In-house or outsource**

- Perform a task in-house or outsource it to a third party
- Outsource if it raises the supply chain surplus more than the firm can on its own
- Keep function in-house if the third party cannot increase the supply chain surplus or if the outsourcing risk is significant

- **Supplier selection**

- Number of suppliers, criteria for evaluation and selection

- **Procurement**

- Obtain goods and service within a supply chain
- Goal is to increase supply chain surplus

- **Sourcing-related metrics**

- **Days payable outstanding** (measures the number of days between when a supplier performed a supply chain task and when it was paid for)
- **Supply quality** (measures the quality of product supplied)
- **Supply lead time** (measures the average time between when an order is placed and when the product arrives)
- **Percentage of on-time deliveries** (measures the fraction of deliveries from the supplier that were on time)
- **Supplier reliability** (measures the variability of the supplier's lead time as well as the delivered quantity relative to plan)

- **Role in the Supply Chain**

- Pricing determines the amount to charge customers for goods and services
- Affects the supply chain level of responsiveness required and the demand profile the supply chain attempts to serve
- Pricing strategies can be used to match demand and supply
- Objective should be to increase firm profit

- **Pricing and economies of scale**
 - The provider of the activity must decide how to price it appropriately to reflect economies of scale
- **Everyday low pricing versus high-low pricing**
 - Different pricing strategies lead to different demand profiles that the supply chain must serve

- **Fixed price versus menu pricing**

- If marginal supply chain costs or the value to the customer vary significantly along some attribute, it is often effective to have a pricing menu
- Can lead to customer behavior that has a negative impact on profits

- **Pricing-related metrics**

- **Profit margin** (measures profit as a percentage of revenue)
- **Days sales outstanding** (measures the average time between when a sale is made and when the cash is collected)
- **Incremental fixed cost per order** (measures the incremental costs that are independent of the size of the order)
- **Incremental variable cost per unit** (measures the incremental costs that vary with the size of the order)
- **Average sale price** (measures the average price at which a supply chain activity was performed in a given period)
- **Average order size** (measures the average quantity per order)
- **Range of sale price** (measures the maximum and the minimum of sale price per unit over a specified time horizon)
- **Range of periodic sales** (measures the maximum and minimum of the quantity sold per period (day/week/month) during a specified time horizon)

Chapter
01

Summary of Learning Objectives

- 1- Identify the major drivers of supply chain performance.
- 2- Discuss the role of each driver in creating a strategic fit between the supply chain strategy and the competitive strategy.
- 3- Define the key metrics that track the performance of the supply chain in terms of each driver.

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Thank You