

Supply chain Management

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Lecture 3

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PMG 660

Supply Chain Drivers and Metrics



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Learning Objectives

After reading this chapter, you will be able to:

- 1. Identify the major drivers of supply chain performance.**
- 2. Discuss the role each driver plays in creating 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.**
- 4. Describe the major obstacles that must be overcome to manage a supply chain successfully.**

Drivers of supply chain performance

The strategic fit requires that a company's supply chain achieve the balance between responsiveness and efficiency that best meets the needs of the company's competitive strategy.

To understand how a company can improve supply chain performance in terms of responsiveness and efficiency, we must examine the logistical and cross functional drivers of supply chain performance and discuss its impact on the performance of the supply chain :

facilities, inventory, transportation, information, sourcing, and pricing.

Framework for structuring drivers

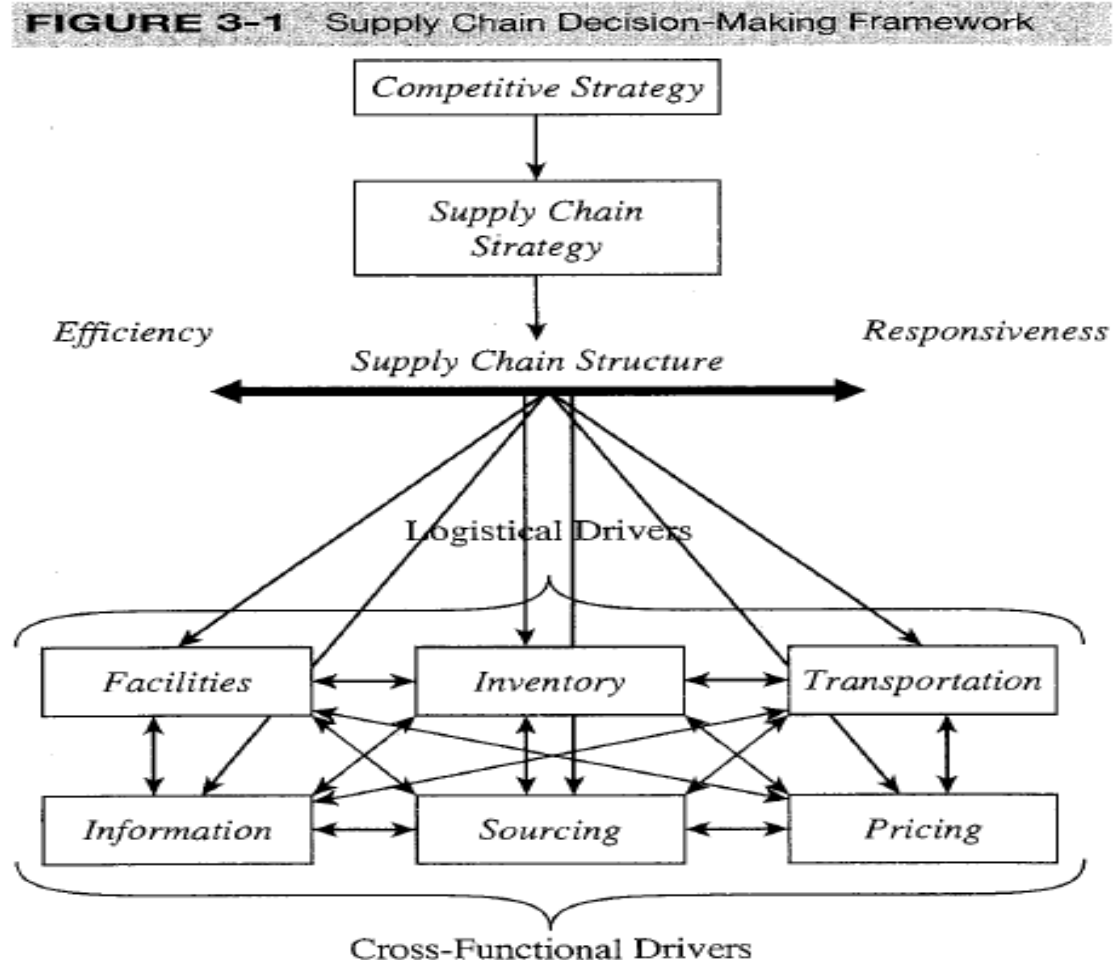
the goal of a supply chain strategy is to strike the balance between responsiveness and efficiency that fits with the competitive strategy.

To reach this goal, a company must structure the right combination of the three logistical and three cross-functional drivers discussed earlier.

- For each of the individual drivers, supply chain managers must make a trade-off between efficiency and responsiveness based on interaction with the other drivers.**
- The combined impact of these drivers then determines the responsiveness and the profits of the entire supply chain.**

Framework for structuring drivers

in Figure 3-1 Most companies begin with a competitive strategy and then decide what their supply chain strategy ought to be. The supply chain strategy determines how the supply chain should perform with respect to efficiency and responsiveness.



Framework for structuring drivers

The supply chain must then use the three logistical and three cross-functional drivers to reach the performance level the supply chain strategy dictates and maximize the supply chain profits.

Although this framework is generally viewed from the top down, in many instances, a study of the six drivers may indicate the need to change the supply chain and potentially even the competitive strategy.

1-Facilities

Facilities are the actual physical locations in the supply chain network where product is stored, assembled, or fabricated.

Role in the supply chain

If we think of inventory as *what* is being passed along the supply chain and transportation as *how* it is passed along, then facilities are the *where* of the supply chain. They are the locations to or from which the inventory is transported. Within a facility, inventory is either transformed into another state (manufacturing) or it is stored (warehousing).

Role in the competitive strategy

Facilities are a key driver of supply chain performance in terms of responsiveness and efficiency.

For example, companies can gain economies of scale when a product is manufactured or stored in only one location; this centralization increases efficiency.

The cost reduction, however, comes at the expense of responsiveness, as many of a company's customers may be located far from the production facility. The opposite is also true.

Components of facilities decisions



Decisions regarding facilities are a crucial part of supply chain design. We now identify components of facilities decisions that companies must analyze.

Role

For production facilities, firms must decide whether they will be flexible, dedicated, or a combination of the two. Flexible capacity can be used for many types of products but is often less efficient, whereas dedicated capacity can be used for only a limited number of products but is more efficient.

Components of facilities decisions

Firms must also decide whether to design a facility with a product focus or a functional focus:

- **A product-focused facility performs many different functions (e.g., fabrication and assembly) in producing a single type of product.**
- **A product focused tends to result in more expertise about a particular type of product at the expense of the functional expertise that comes from a functional methodology.**
- **A functional-focused facility performs few functions (e.g., only fabrication or only assembly) on many types of products**



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Components of facilities decisions

For warehouses and DCs, firms must decide whether they will be primarily crossdocking facilities or storage facilities.

At cross-docking facilities, inbound trucks from suppliers are unloaded; the product is broken into smaller lots, and is quickly loaded onto store-bound trucks.

Each store-bound truck carries a variety of products, some from each inbound truck. For storage facilities, firms must decide on the products to be stored at each facility.

a-Location

Deciding where a company will locate its facilities constitutes a large part of the design of a supply chain.

A basic trade-off here is whether to centralize in order to gain economies of scale or to decentralize to become more responsive by being closer to the customer.

- **various characteristics of the local area in which the facility is situated include macroeconomic factors, quality of workers, cost of workers, cost of facility, availability of infrastructure, proximity to customers, the location of that firm's other facilities, tax effects, and other strategic factors.**

b-Capacity

Companies must also determine a facility's capacity to perform its intended function or functions.

A large amount of excess capacity allows the facility to be very flexible and to respond to wide swings in the demands placed on it . Excess capacity, however, costs money and therefore can decrease efficiency.

A facility with little excess capacity will likely be more efficient per unit of product .

Therefore, a company must make a trade-off to determine the right amount of capacity to have at each of its facilities.

- **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. Quality losses hurt both financial performance and responsiveness.
 - **Theoretical flow/cycle time of production** measures the time required to process a unit if there are absolutely no delays at any stage.



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- **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. The actual flow/cycle time includes the theoretical time and any delays.
 - **Product variety** measures the number of products or product families processed in a facility. Processing costs and flow times are likely to increase with product variety.
 - **Average production batch size** measures the average amount produced in each production batch. Large batch sizes will decrease production cost but increase inventories.
 - **Production service level** measures the fraction of production orders completed on time and in full.
- 3.5 Invento

Overall trade-off: responsiveness versus efficiency

The fundamental trade-off that managers face when making facilities decisions is between the cost of the number, location, and type of facilities (efficiency) and the level of responsiveness that these facilities provide the company's customers.

Increasing the number of facilities increases facility and inventory costs but decreases transportation costs and reduces response time. Increasing the flexibility of a facility increases facility costs but decreases inventory costs and response time.

2-Inventory



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encompasses all raw materials, work in process, and finished goods within a supply chain.

Role in the supply chain

Inventory exists in the supply chain because of a mismatch between supply and demand. This mismatch is intentional at a steel manufacturer, where it is economical to manufacture in large lots that are then stored for future sales.

Inventory

The mismatch is also intentional at a retail store where inventory is held in anticipation of future demand.

- **An important role that inventory plays in the supply chain is to increase the amount of demand that can be satisfied by having the product ready and available when the customer wants it.**
- **Another significant role that inventory plays is to reduce cost by exploiting economies of scale that may exist during production and distribution.**

Role in the competitive strategy



Inventory plays a significant role in a supply chain's ability to support a firm's competitive strategy.

If a firm's competitive strategy requires a very high level of responsiveness, a company can achieve this responsiveness by locating large amounts of inventory close to the customer.

Conversely, a company can also use inventory to become more efficient by reducing inventory through centralized stocking. This strategy would support a competitive strategy of being a low cost producer

- Related Metrics Inventory-related decisions affect the cost of goods sold,
- **Inventory turns** measure the number of times inventory turns over in a year.
 - **Average replenishment** batch size measures the average amount in each replenishment order.
 - **Average safety inventory** measures the average amount of inventory on hand when a replenishment order arrives.
 - **Seasonal inventory** measures the amount by which the inflow of product exceeds its sales (beyond cycle and safety inventory).
 - **Fill rate (order/case)** measures the fraction of orders/demand that were met on time from inventory.
 - **Fraction of time out of stock measures** the fraction of time that a particular SKU had zero inventory. This fraction can be used to estimate the lost sales during the stock out period. •
 - **Obsolete inventory** measures the fraction of inventory older than a specified obsolescence date

3-Transportation

entails moving inventory from point to point in the supply chain.

Role in the supply chain

Transportation moves product between different stages in a supply chain. Like the other supply chain drivers, transportation has a large impact on both responsiveness and efficiency. Faster transportation allows a supply chain to be more responsive but reduces its efficiency.

Transportation



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The type of transportation a company uses also affects the inventory and facility locations in the supply chain.

Dell, for example, flies some components from Asia because doing so allows the company to lower the level of inventory it holds.

Clearly, such a practice also increases responsiveness but decreases transportation efficiency because it is more costly than transporting parts by ship.

Role in the competitive strategy



The role of transportation in a company's competitive strategy figures prominently in the company's consideration of the target customer's needs.

If a firm's competitive strategy targets a customer who demands a very high level of responsiveness, and that customer is willing to pay for this responsiveness, then a firm can use transportation as one driver for making the supply chain more responsive.

Transportation-Related Metrics Inbound transportation decisions affect the cost of goods sold, whereas outbound transportation costs are part of the selling, general, and administrative expenses.

- **Average inbound** transportation cost typically measures the cost of bringing product into a facility.
 - **Average outbound** transportation cost measures the cost of sending product out of a facility to the customer
 - **Fraction transported by mode** measures the fraction of transportation (in units or dollars) using each mode of transportation. This metric can be used to estimate whether certain modes are overused or underused

4-Information



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consists of data and analysis concerning facilities, inventory, transportation, costs, prices, and customers throughout the supply chain

Role in the supply chain

Information deeply affects every part of the supply chain. Its impact is easy to underestimate, as information affects a supply chain in many different ways. Consider the following:

1. Information serves as the connection between various stages of a supply chain, allowing them to coordinate and maximize total supply chain profitability.

Information

2. Information is also crucial to the daily operations of each stage in a supply chain. For instance, a production scheduling system uses information on demand to create a schedule that allows a factory to produce the right products in an efficient manner.

A warehouse management system uses information to create visibility of the warehouse's inventory. The company can then use this information to determine whether new orders can be filled.

Information-Related Metrics

- **Forecast horizon** identifies how far in advance of the actual event a forecast is made. The forecast horizon must be greater than or equal to the lead time of the decision that is driven by the forecast.

- **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.

5-Sourcing

is the choice of who will perform a particular supply chain activity such as production, storage, transportation, or the management of information.

Role in the supply chain

Sourcing is the set of business processes required to purchase goods and services. Managers must first decide which tasks will be outsourced and those that will be performed within the firm. For each outsourced task, the manager must decide whether to source from a single supplier or a portfolio of suppliers. If a portfolio of multiple suppliers is to be carried, then the role of each supplier in the portfolio must be clarified.

Sourcing



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The next step is to identify the set of criteria that will be used to select suppliers and measure their performance. Managers then select suppliers and negotiate contracts with them.

Contracts define the role of each supply source and should be structured to improve supply chain performance and minimize information distortion from one stage to the next.

Once suppliers and contracts are in place, procurement processes that facilitate the placement and delivery of orders play a major role.

Role in the competitive strategy

Sourcing decisions are crucial because they affect the level of efficiency and responsiveness the supply chain can achieve. In some instance, firms outsource to responsive third parties if it is too expensive for them to develop this responsiveness on their own. An example is the outsourcing of next-day delivery by all firms to a few package carriers because it is too expensive for a firm to develop next-day delivery capability on its own.

Sourcing-Related Metrics:

Sourcing decisions have a direct impact on the cost of goods sold and accounts payable. T

- **Days payable outstanding** measures the number of days between when a supplier performed a supply chain task and when it was paid for.
- **Average purchase price** measures the average price at which a good or service was purchased during the year.
- **Range of purchase price** measures the fluctuation in purchase price during a specified period.
- **Average purchase quantity** measures the average amount purchased per order. The goal is to identify whether a sufficient level of aggregation is occurring across locations when placing an order.

- **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

6-Pricing

In this section we discuss the role that pricing plays in the supply chain.

Role in the supply chain

Pricing is the process by which a firm decides how much to charge customers for its goods and services. Pricing affects the customer segments that choose to buy the product, as well as the customer's expectations. This directly affects the supply chain in terms of the level of responsiveness required as well as the demand profile that the supply chain attempts to serve.

Pricing-cont

Pricing is also a lever that can be used to match supply and demand. Short-term discounts can be used to eliminate supply surpluses or decrease seasonal demand spikes by moving some of the demand forward.

In short, pricing is one of the most significant factors that affect the level and type of demand that the supply chain will face.

Role in the competitive strategy

Pricing is a significant attribute through which a firm executes its competitive strategy. For example, Costco, a membership-based wholesaler in the United States, has a policy that prices are kept steady but low. Customers expect low prices but are comfortable with a lower level of product availability. The steady prices also ensure that demand stays relatively stable. Costco serves a well defined segment, and it can thus design an appropriate supply chain.

Pricing-Related Metrics Pricing directly affects revenues but can also affect production costs and inventories,

- **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 (changeover costs at a manufacturing plant or order processing or transportation costs)
- **Incremental variable cost per unit** measures (picking costs at a mail-order firm or variable production costs at a manufacturing plant).
- **Average sale price** measures the average price at which a supply chain activity was performed in a given period.
- **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.

Obstacles to achieving strategic fit



The key to achieving strategic fit is a company's ability to find a balance between responsiveness and efficiency that best matches the needs of its target customer. In deciding where this balance should be located on the responsiveness spectrum, companies face many obstacles. In this section we discuss some of the obstacles and also provide a feel for how the supply chain environment has changed over the years.

Obstacles to achieving strategic fit

On one hand, these obstacles have made it much more difficult for companies to create the ideal balance. On the other hand, they have afforded companies increased opportunities for improving supply chain management.

Managers need a solid understanding of the impact of these obstacles because they are critical to a company's ability to reap the maximum profitability from its supply chain.

Increasing variety of products

Product proliferation is rampant today. With customers demanding ever more customized products, manufacturers have responded with mass customization and even segment-of-one (companies view each customer as an independent market segment) views of the market. Products that were formerly quite generic are now custom-made for a specific consumer.

Decreasing product life cycles

In addition to the increasing variety of product types, the life cycle of products has been shrinking. Today there are products whose life cycles can be measured in months, compared to the old standard of years. These are not just niche products, either. PCs now have a life cycle of several months, and even some automobile manufacturers have lowered their product life cycles from five plus years to about three years.

Increasingly demanding customers

Customers are constantly demanding improvements in delivery lead times, cost, and product performance. If they do not receive these improvements, they move on to new suppliers.

Many companies had periodic, standard price increases--not due to a rise in demand or any other factor, but simply because raising prices was the way business was done.

Increasingly demanding customers



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Now, one repeatedly sees companies that cannot force through any price increases without losing market share.

Today's customers are demanding faster fulfillment, better quality, and better-performing products for the same price they paid years ago.

This tremendous growth in customer demands (not necessarily demand) means that the supply chain must provide more just to maintain its business.

Fragmentation of supply chain ownership

Over the past several decades, most firms have become less vertically integrated.

As companies have shed noncore functions, they have been able to take advantage of supplier and customer competencies that they themselves did not have.

This new ownership structure, however, has also made managing the supply chain more difficult.

Fragmentation of supply chain ownership

With the chain broken into many owners, each with its own policies and interests, the chain is more difficult to coordinate.

Potentially, this problem could cause each stage of a supply chain to work only toward its own objectives rather than the whole chain's, resulting in the reduction of overall supply chain profitability.

Globalization

Supply chains today are more likely than ever to be global. Establishing a global supply chain creates many benefits, such as the ability to source from a global base of suppliers who may offer better or cheaper goods than were available in a company's home nation.

Globalization, however, also adds stress to the chain, because facilities within the chain are farther apart, making coordination much more difficult.

Difficulty executing new strategies

Creating a successful supply chain strategy is not easy.

Once a good strategy is formulated, however, the execution of the strategy can be even more difficult. For instance, Toyota's production system, which is a supply chain strategy, has been widely known and understood.

Yet this strategy has been a sustained competitive advantage for Toyota for more than two decades. Does Toyota have a brilliant strategy that no one else can figure out? Their strategy is brilliant, but many others have figured it out.

Difficulty executing new strategies

The difficulty other firms have had is in executing that strategy.

Many highly talented employees at all levels of the organization are necessary to make a supply chain strategy successful.

Although we deal mostly with the formulation, one should keep in mind that skillful execution of a strategy can be as important as the strategy itself.

Reference

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Chapter 3