

Supply Chain Management

Prepared by Dr. Tarek Mohamed

MGM 660

Lecture 4



The background features a series of vertical panels with rounded ends. The first panel shows hands typing on a laptop. The second panel shows a laptop screen with a play button icon. The third panel shows a target icon. The fourth panel shows an open book and a magnifying glass icon. The fifth panel is a solid light blue color.

Designing distribution networks in the Supply Chain

Lecture 4

MGM 660

Prepared by
Dr. Tarek Mohamed

Course Agenda

Chapter

01

- 
- 1- Identify the key factors to be considered when designing a distribution network.
 - 2- Discuss the strengths and weaknesses of various distribution options.
 - 3- Understand how e-business have affected the design of distribution networks in different industries.
 - 4- Understand the role of AI in designing distribution networks in the Supply Chain

- **Distribution** – the steps taken to move and store a product from the supplier stage to the customer stage in a supply chain
- **Distribution-** is a key driver of the overall profitability of a firm because it affects both the supply chain cost and the customer value directly
- Choice of distribution network can achieve supply chain objectives from low cost to high responsiveness
- In the apparel retail industry, for example, distribution affects about 35 percent of the revenue (including its influence on markdowns and lost sales).

The Role of Distribution in the Supply Chain

- Until 2007, **Dell** distributed its PCs directly to end consumers, whereas companies such as **HP** distributed through resellers.
- Dell customers waited several days to get a PC, whereas customers could walk away with an **HP** computer from a reseller.
- Starting in June 2007, Dell also started selling its PCs through retailers such as Walmart.
- **IKEA** Role of Distribution: Uses centralized warehouses and regional distribution centers. Employs flat-pack packaging to reduce transportation and storage costs. Supply Chain Benefit: Lower logistics costs and efficient inventory management.

Amazon

Role of Distribution:

- Uses a vast network of fulfillment centers and distribution hubs.
- Ensures fast delivery, including same-day and next-day shipping.
- Optimizes inventory placement close to customers.

Supply Chain Benefit:

- Reduced delivery times and improved customer satisfaction.

Walmart

Role of Distribution:

- Operates large regional distribution centers that supply retail stores.
- Uses advanced logistics systems to replenish inventory efficiently.

Supply Chain Benefit:

- Lower transportation costs and high product availability.

Coca-Cola

Role of Distribution:

- Uses bottling plants, warehouses, wholesalers, and retailers to distribute products worldwide.
- Ensures beverages are available in supermarkets, restaurants, and convenience stores.

Supply Chain Benefit:

- Wide market coverage and consistent product availability.

Apple

Role of Distribution:

- Distributes products through online stores, retail stores, and authorized resellers.
- Uses centralized warehouses and logistics partners for global distribution.

Supply Chain Benefit:

- Efficient global product launches and inventory management

FedEx

Role of Distribution:

- Provides transportation and distribution services for businesses worldwide.
- Uses hub-and-spoke distribution networks.

Supply Chain Benefit:

- Fast and reliable delivery of goods.

DHL

Role of Distribution:

- Manages warehousing, transportation, and international distribution.
- Connects manufacturers with global markets.

Supply Chain Benefit:

- Efficient cross-border movement of products.

Designing Distribution Networks in the Supply Chain

- Distribution network design is the process of determining how products move from manufacturers to customers in the most efficient and cost-effective way.
- It involves deciding the number, location, and roles of facilities such as factories, warehouses, distribution centers, and retail outlets.

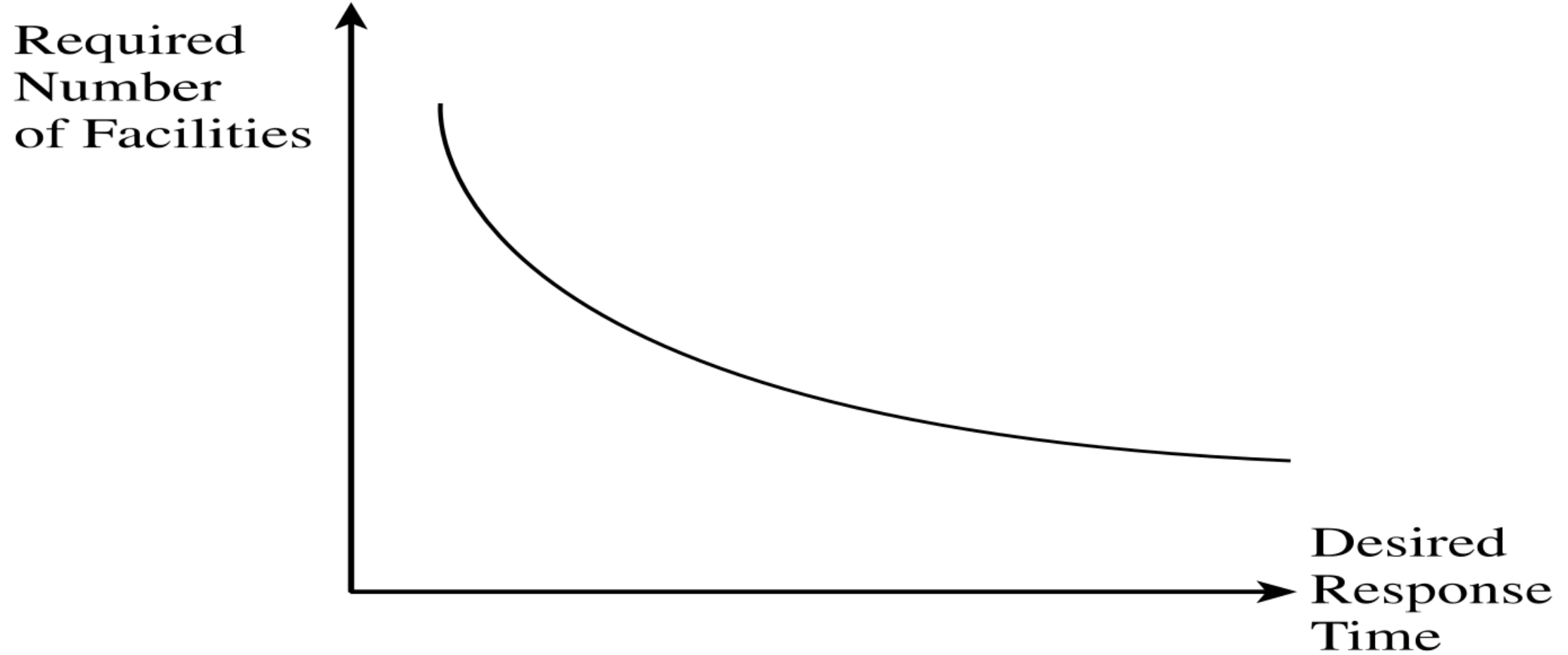
Objectives of Distribution Network Design

- Minimize total supply chain costs.
- Improve customer service levels.
- Reduce delivery times.
- Increase product availability.
- Optimize inventory levels.

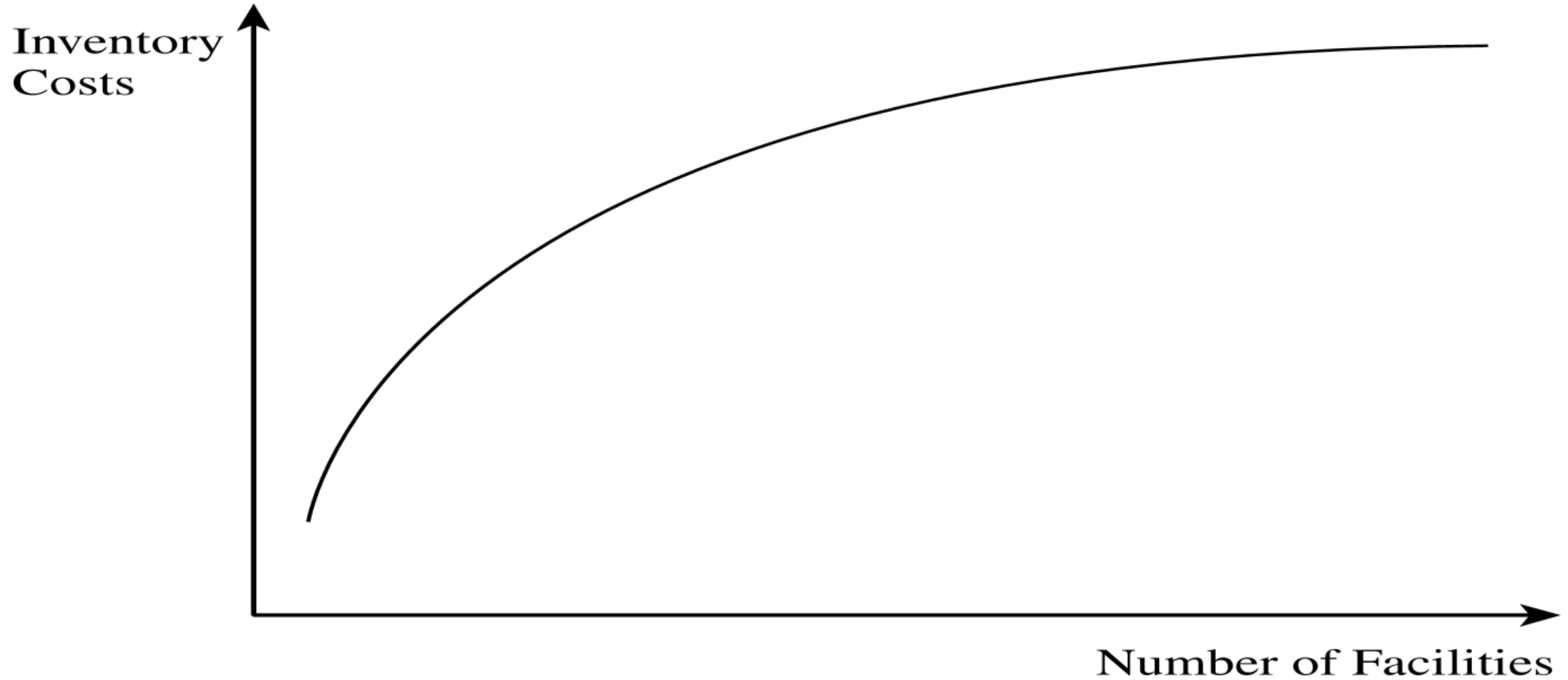
- Distribution network performance evaluated along two dimensions
 1. **Customer needs that are met**
 2. **Cost of meeting customer needs**
- Evaluate the impact on customer service and cost for different distribution network options
- Profitability of the delivery network is determined by revenue from meeting customer needs and network costs
- Inbound transportation costs are costs incurred in bringing material into a facility
- Outbound transportation costs are costs incurred in sending material out of a facility

- **Elements of customer service influenced by network structure:**
 - Response time
 - Product variety
 - Product availability
 - Customer experience
 - Order visibility
 - Returnability

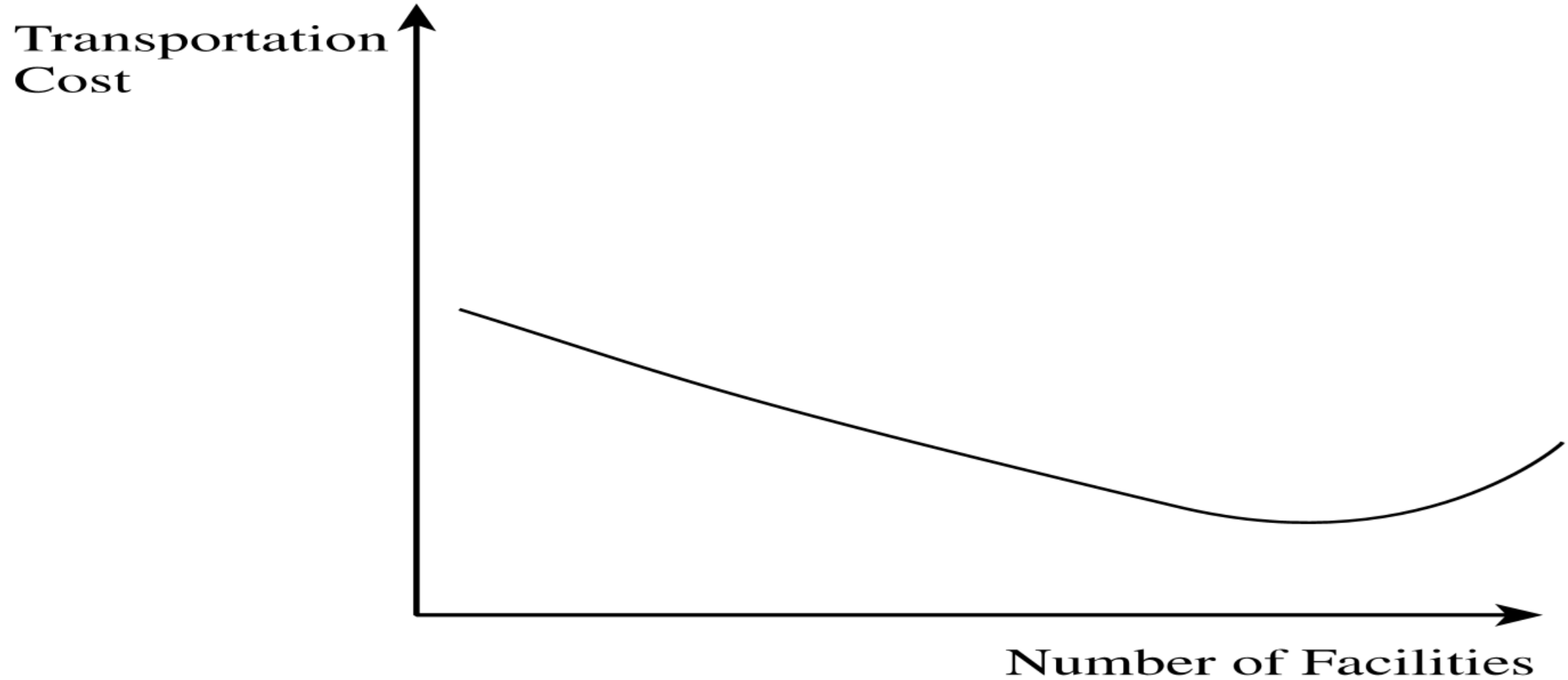
Desired Response Time and Number of Facilities



Inventory Costs and Number of Facilities



Transportation Costs and Number of Facilities



Factors Influencing Distribution Network Design

- **Supply chain costs affected by network structure:**
 - **Inventories**
 - **Transportation**
 - **Facilities and handling**
 - **Information**
- ❑ The choice of the distribution network can be used to achieve supply chain objectives such as low cost and high responsiveness
- ❑ Total logistics costs for a supply chain network are a sum of inventory, transportation, and facility costs

- **Distribution network choices from the manufacturer to the end consumer**
- **Two key decisions**
 1. Will product be delivered to the customer location or picked up from a prearranged site?
 2. Will product flow through an intermediary (or intermediate location)?

- **One of six designs may be used**
 1. Manufacturer storage with direct shipping
 2. Manufacturer storage with direct shipping and in-transit merge
 3. Distributor storage with carrier delivery
 4. Distributor storage with last-mile delivery
 5. Manufacturer/distributor storage with customer pickup
 6. Retail storage with customer pickup

Manufacturer Storage with Direct Shipping Network

Cost Factor	Performance
Inventory	Lower costs because of aggregation. Benefits of aggregation are highest for low-demand, high-value items. Benefits are large if product customization can be postponed at the manufacturer.
Transportation	Higher transportation costs because of increased distance and disaggregate shipping.
Facilities and handling	Lower facility costs because of aggregation. Some saving on handling costs if manufacturer can manage small shipments or ship from production line.
Information	Significant investment in information infrastructure to integrate manufacturer and retailer.

Manufacturer Storage with Direct Shipping Network

Service Factor	Performance
Response time	Long response time of one to two weeks because of increased distance and two stages for order processing. Response time may vary by product, thus complicating receiving.
Product variety	Easy to provide a high level of variety.
Product availability	Easy to provide a high level of product availability because of aggregation at manufacturer.
Customer experience	Good in terms of home delivery but can suffer if order from several manufacturers is sent as partial shipments.
Time to market	Fast, with the product available as soon as the first unit is produced.
Order visibility	More difficult but also more important from a customer service perspective.
Returnability	Expensive and difficult to implement.

In-Transit Merge

Cost Factor	Performance
Inventory	Similar to drop-shipping.
Transportation	Somewhat lower transportation costs than drop-shipping.
Facilities and handling	Handling costs higher than drop-shipping at carrier; receiving costs lower at customer.
Information	Investment is somewhat higher than for drop-shipping.

In-Transit Merge

Service Factor	Performance
Response time	Similar to drop-shipping; may be marginally higher.
Product variety	Similar to drop-shipping.
Product availability	Similar to drop-shipping.
Customer experience	Better than drop-shipping because only a single delivery has to be received.
Time to market	Similar to drop-shipping.
Order visibility	Similar to drop-shipping.
Returnability	Similar to drop-shipping.

Distributor Storage with Carrier Delivery

Cost Factor	Performance
Inventory	Higher than manufacturer storage. Difference is not large for faster moving items but can be large for very slow-moving items.
Transportation	Lower than manufacturer storage. Reduction is highest for faster moving items.
Facilities and handling	Somewhat higher than manufacturer storage. The difference can be large for very slow-moving items.
Information	Simpler infrastructure compared to manufacturer storage.

Distributor Storage with Carrier Delivery

Service Factor	Performance
Response time	Faster than manufacturer storage.
Product variety	Lower than manufacturer storage.
Product availability	Higher cost to provide the same level of availability as manufacturer storage.
Customer experience	Better than manufacturer storage with drop-shipping.
Time to market	Higher than manufacturer storage.
Order visibility	Easier than manufacturer storage.
Returnability	Easier than manufacturer storage.

Distributor Storage with Last Mile Delivery

Cost Factor	Performance
Inventory	Higher than distributor storage with package carrier delivery.
Transportation	Very high cost given minimal scale economies. Higher than any other distribution option.
Facilities and handling	Facility costs higher than manufacturer storage or distributor storage with package carrier delivery, but lower than a chain of retail stores.
Information	Similar to distributor storage with package carrier delivery.

Distributor Storage with Last Mile Delivery

Service Factor	Performance
Response time	Very quick. Same day to next-day delivery.
Product variety	Somewhat less than distributor storage with package carrier delivery but larger than retail stores.
Product availability	More expensive to provide availability than any other option except retail stores.
Customer experience	Very good, particularly for bulky items. Slightly higher than distributor storage with package carrier delivery.
Time to market	Less of an issue and easier to implement than manufacturer storage or distributor storage with package carrier delivery.
Order visibility	Easier to implement than other previous options.
Returnability	Harder and more expensive than a retail network.

Cost Factor	Performance
Inventory	Can match any other option, depending on the location of inventory.
Transportation	Lower than the use of package carriers, especially if using an existing delivery network.
Facilities and handling	Facility costs can be high if new facilities have to be built. Costs are lower if existing facilities are used. The increase in handling cost at the pickup site can be significant.
Information	Significant investment in infrastructure required.

Service Factor	Performance
Response time	Similar to package carrier delivery with manufacturer or distributor storage. Same-day delivery possible for items stored locally at pickup site.
Product variety	Similar to other manufacturer or distributor storage options.
Product availability	Similar to other manufacturer or distributor storage options.
Customer experience	Lower than other options because of the lack of home delivery. Experience is sensitive to capability of pickup location.
Time to market	Similar to manufacturer storage options.
Order visibility	Difficult but essential.
Returnability	Somewhat easier given that pickup location can handle returns.

Retail Storage with Customer Pickup

Cost Factor	Performance
Inventory	Higher than all other options.
Transportation	Lower than all other options.
Facilities and handling	Higher than other options. The increase in handling cost at the pickup site can be significant for online and phone orders.
Information	Some investment in infrastructure required for online and phone orders.

Retail Storage with Customer Pickup

Service Factor	Performance
Response time	Same-day (immediate) pickup possible for items stored locally at pickup site.
Product variety	Lower than all other options.
Product availability	More expensive to provide than all other options.
Customer experience	Related to whether shopping is viewed as a positive or negative experience by customer.
Time to market	Highest among distribution options.
Order visibility	Trivial for in-store orders. Difficult, but essential, for online and phone orders.
Returnability	Easier than other options because retail store can provide a substitute.

- **Response time to customers**
 - Physical products take longer to fulfill than retail store
 - No delay for information goods
- **Product variety**
 - Easier to offer larger selection
- **Product availability**
 - Aggregating inventory and better information on customer preferences improves product availability

- **Customer experience**
 - Improved access, customization, and convenience
- **Faster time to market**
- **Order Visibility**
- **Returnability**
 - Harder with online orders
 - Proportion of returns likely to be much higher

- **Direct Sales to Customers**

Social networking channels allow firms to directly pitch products and promotion

- **Flexible Pricing, Product Portfolio, and Promotions**

Manage revenues from product portfolio more effectively than traditional channels

Promotion information can be conveyed to customers quickly and inexpensively

- **Efficient Funds Transfer**

Inventory

- Lower inventory levels if customers will wait
- Postpone variety until after the customer order is received

Facilities

- Costs related to the number and location of facilities in a network
- Costs associated with the operations in these facilities

Transportation

- Lower cost of “transporting” information goods in digital form
- For nondigital, aggregating inventories increases outbound transportation

Information

- Share demand, planning, and forecasting information throughout its supply chain
- Additional costs to build and maintain the information infrastructure

❑ Impact of online sales on customer service

- Delay in fulfilling customer request

❑ Impact of online sales on cost

- Reduced inventory costs
- Lower facility costs
- Higher total transportation costs
- Incremental increase in information costs

A tailored supply chain network to sell computer hardware for Dell includes :

- A hybrid model can be very effective
- More significant as hardware becomes more of a commodity
- Take advantage of the strengths of both online sales and traditional retail and distribution channels

- **Impact of online sales on customer service**
 - Internet has not shortened supply chains
 - Increased selection, convenience
- **Impact of online sales on cost**
 - Reduced inventory costs
 - Lower facility costs
 - Higher total transportation costs
 - Increase in information costs
- **A supply chain network for books**
 - Traditional bookstores pressured from both ends
 - Amazon more efficient

- **Impact of online sales on customer service**
 - Sell convenience and the time savings
 - Offers less variety
 - Creating a personalized shopping experience and customized advertising and promotions
- **Impact of online sales on cost**
 - Reduced inventory costs
 - Higher facility costs due to picking operation
 - Significantly higher total transportation costs
 - Increase in information costs

The Role of AI in Designing Distribution Networks in the Supply Chain

Artificial Intelligence (AI) helps companies design and optimize distribution networks by analyzing large amounts of data, predicting demand, and recommending the most efficient locations, inventory levels, and transportation routes.

Key Roles of AI in Distribution Network Design

Demand Forecasting

AI analyzes historical sales, market trends, weather patterns, and customer behavior to predict future demand.

Benefits:

- More accurate forecasts
- Reduced stockouts and excess inventory
- Better warehouse location decisions

Warehouse and Distribution Center Location Optimization

AI evaluates factors such as customer locations, transportation costs, labor availability, and delivery times to determine the best locations for warehouses and distribution centers.

Benefits:

- Lower logistics costs
- Faster deliveries
- Improved customer service

Route Optimization

AI identifies the most efficient transportation routes by considering traffic, fuel costs, weather conditions, and delivery schedules.

Benefits:

- Reduced transportation costs
- Shorter delivery times
- Lower fuel consumption

Inventory Optimization

AI determines how much inventory should be stored at each warehouse or distribution center.

Benefits:

- Lower inventory holding costs
- Higher product availability
- Improved supply chain efficiency

Risk Management

AI can identify potential disruptions such as supplier delays, natural disasters, or transportation bottlenecks.

Benefits:

- Better contingency planning
- Increased supply chain resilience
- Reduced operational risks

Amazon

- Uses AI to forecast demand and position inventory in fulfillment centers close to customers.
- Optimizes warehouse operations and delivery routes.

Walmart

- Uses AI for demand forecasting and inventory optimization across its distribution network.
- Improves product availability while reducing costs.

DHL

- Uses AI-powered analytics to optimize transportation routes and warehouse operations.
- Enhances delivery speed and operational efficiency.

UPS

- Uses AI-based route optimization systems to reduce travel distance and fuel consumption.
- Improves delivery performance and sustainability.

- ❑ The ownership structure of the distribution network can have as big an impact as the type of distribution network
- ❑ It is important to have adaptable distribution networks
- ❑ Product price, commoditization, and criticality affect the type of distribution system preferred by customers
- ❑ Integrate the Internet with the existing physical network
- ❑ Consider whether an exclusive distribution strategy is advantageous

Summary of Learning Objectives



Chapter 01

- 1- Identify the key factors to be considered when designing a distribution network.
- 2- Discuss the strengths and weaknesses of various distribution options.
- 3- Understand how e-business have affected the design of distribution networks in different industries.
- 4- Understand the role of AI in designing distribution networks in the Supply Chain

- Chopra, S., & Meindl, P. (2016). Global Edition. Pearson Education Limited **Chapter 4.**
- Lysons, K., & Farrington, B. (2020). *Procurement and supply chain management*. Pearson UK.
- Morris, P. W., & Pinto, J. K. (Eds.). (2007). The Wiley guide to project technology, supply chain, and procurement management (Vol. 4). John Wiley & Sons.
- Schwalbe, K. (2015). *Information technology project management*. Cengage Learning.
- Supply Chain Council



Thank You