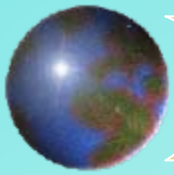


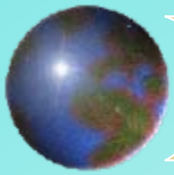
Lecture 6

Warehousing



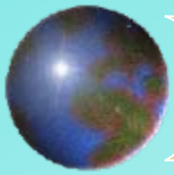
Warehousing

- ❖ Definition
- ❖ The importance of warehousing
- ❖ Factors influencing a firm's warehousing policies
- ❖ Functions of warehousing
- ❖ Warehouse ownership classification
- ❖ Warehouse decision strategy
- ❖ Warehouse planning and management
- ❖ Materials handling



1. Definition

We can define warehousing as that part of a firm's logistics system that stores products (raw materials, parts, goods-in-process, finished goods) at and between point-of-origin and point-of-consumption, and provides information to management on the status, condition, and disposition of items being stored.



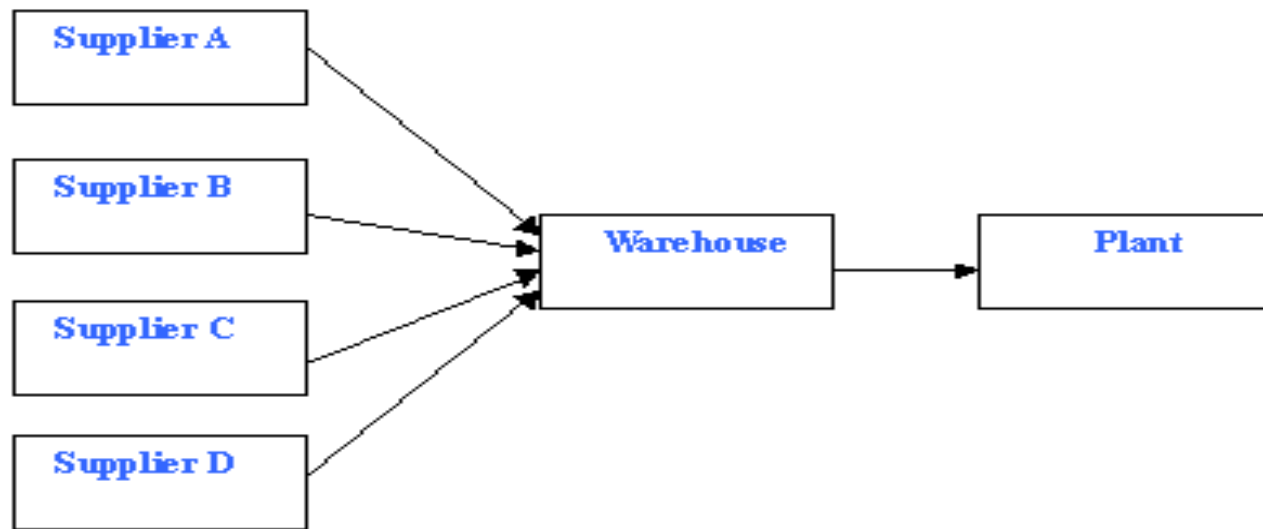
2. Importance of warehousing

- **To achieve transportation economies.**
- **To achieve production economies.**
- **To take advantage of quantity purchase discounts.**
- **To support the firm's customer service policies.**
- **To meet changing market conditions.**
- **To overcome the time and space differentials.**
- **To accomplish least total cost logistics.**



Transportation economies

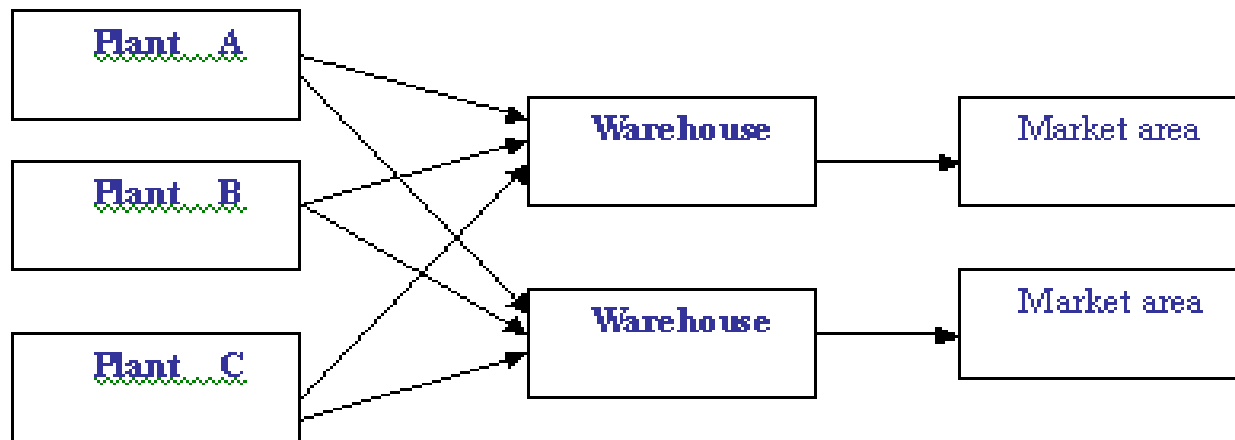
Figun 6 -1 Transportation Consolidations Made Possible by Warehousing



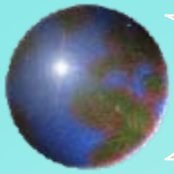
A. Physical supply system



Figur 6 -1 Transportation Consolidations Made Possible by Warehousing

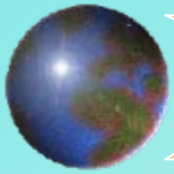


B. Physical distribution system



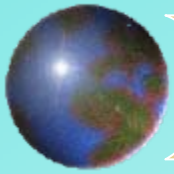
Production economies

- Short production runs
- Long production runs
 - Setups cost
 - Changeover cost
 - Stock-out cost (lost sales cost)
 - Production cost
 - Inventory cost
 - Warehousing cost



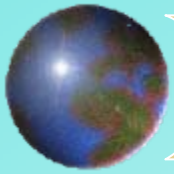
Quantity purchase discount

- Lower per-unit price and transportation costs
- Similar discounts and savings can accrue to manufacturers, retailers, and wholesalers.



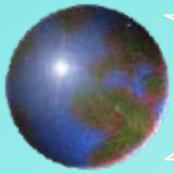
To support customer service policy

A 48-hour delivery standard, may require a number of field warehouses in order to minimize total costs while achieving the standard.



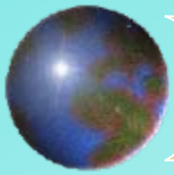
To meet changing market condition

- uncertain consumer demand and the timing of retailer and wholesaler orders.
- quick response to customers



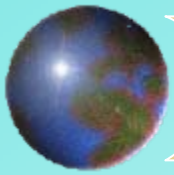
To accomplish least total cost logistics

The use of warehousing enables management to select the transport modes and inventory levels that, when combined with communication and order processing systems and production alternatives, minimize total costs while providing a desired level of customer service.



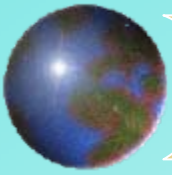
3. Factors influencing a firm's warehousing policies

- **industry;**
- **firm's philosophy;**
- **capital availability;**
- **product characteristics;**
- **economic conditions;**
- **competition;**
- **seasonality of demand;**
- **production process**



4. Functions of warehousing

- Movement
- storage
- information transfer



Movement function



receiving



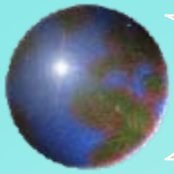
transfer



order selection

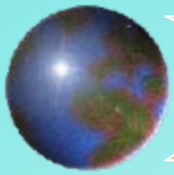


shipping



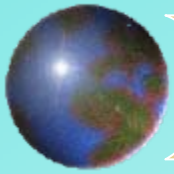
Receiving

- physical unloading of products from the transportation carrier;
- updating of warehouse inventory records, inspection for damage;
- verification of the merchandise count against orders and shipping records.



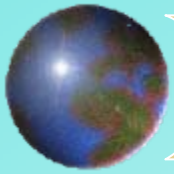
Transfer

- physical movement of the product into the warehouse for storage;
- movement to areas for specialized services such as consolidation
- movement to out-bound shipment;



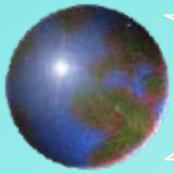
Order selection

- regrouping products into the assortments customers desire;
- Packing slips.



Shipping

- product staging;
- physically moving the assembled orders into carrier equipment;
- adjusting inventory records;
- checking on orders to be shipped.



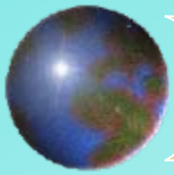
Storage



Temporary

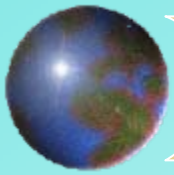


semi-permanent



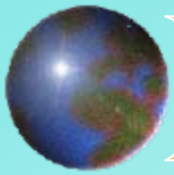
➤ Temporary storage

- **Temporary storage emphasizes the movement function of the warehouse and includes only the storage of product necessary for basic inventory replenishment.**
- **Temporary storage is required regardless of the actual inventory turnover.**
- **The extent of temporary inventory storage depends on the design of the logistics system and the variability experienced in lead time and demand.**



➤ Semi-permanent storage

- Semi-permanent storage is the storage of inventory in excess of that required for normal replenishment.
- The most common conditions
 - ✓ (1) seasonal demand
 - ✓ (2) erratic demand
 - ✓ (3) conditioning of products
 - ✓ (4) speculation
 - ✓ (5) special deals

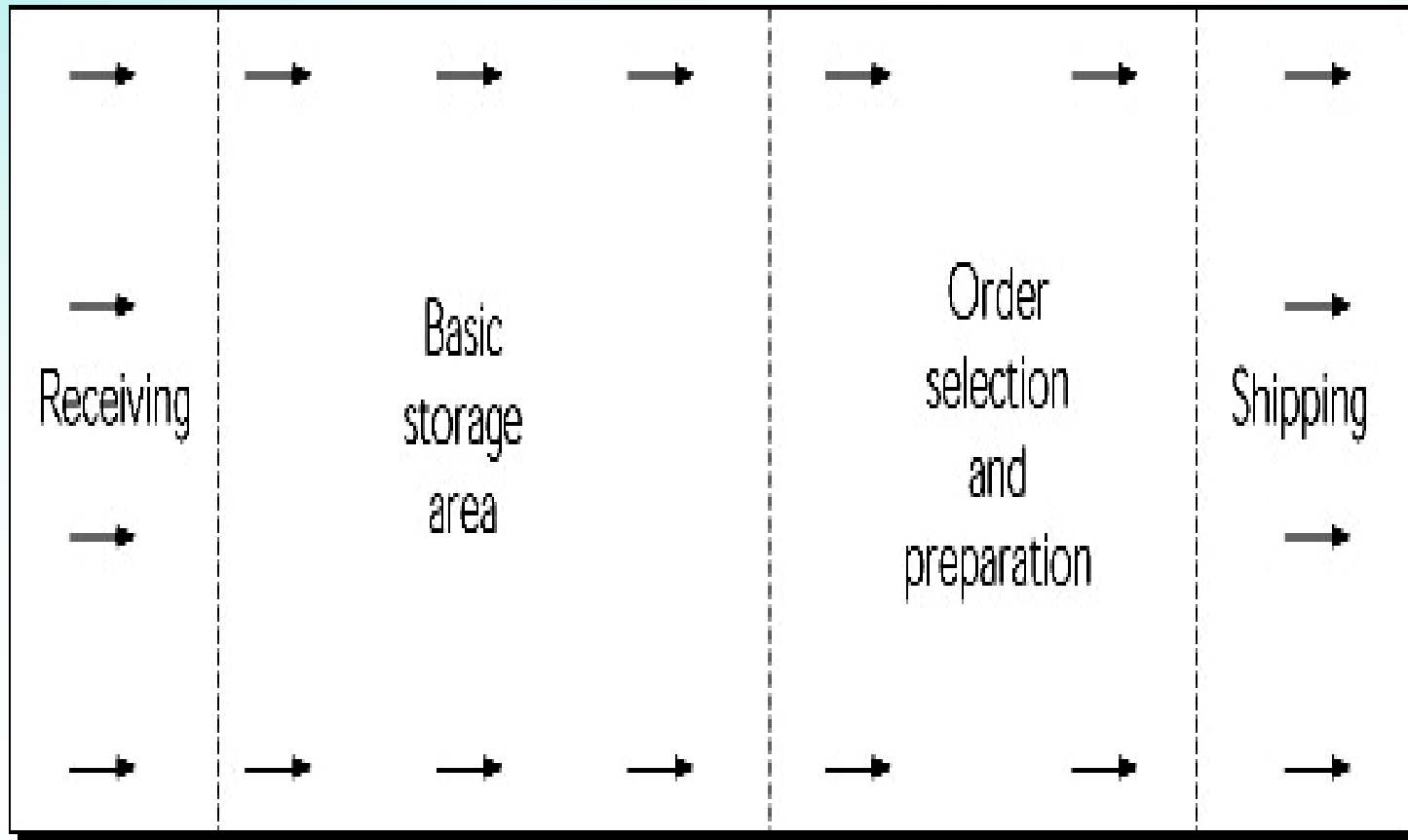


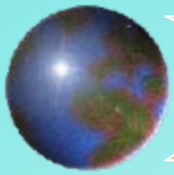
Information transfer

- It occurs simultaneously with the movement and storage functions.
- Timely and accurate information on inventory levels, throughput levels, stock-keeping locations, inbound and outbound shipments, customer data, facility space utilization, and personnel is vital to the successful operation of warehouse.



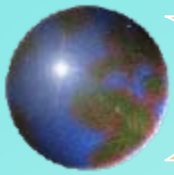
The operation of warehouse





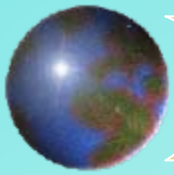
5. Warehouse Ownership Classification

- Private**
- Public**
- Contract**



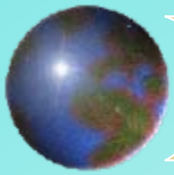
Private warehouse

- A private warehouse is typically operated by the firm owning the product.
- The major benefits are control, flexibility, cost and a range of intangibles.



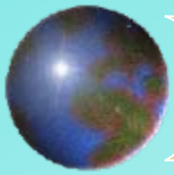
Public warehouse

- A public warehouse is operated as an independent business offering a range of for-hire services.
- Kinds of product include general merchandise, refrigerated, special commodity, bonded, and household goods and furniture.
- Benefits: lower cost, flexibility, market distribution
- Value-added services: cross-dock, postponement, customization, reverse logistics, specialty packaging



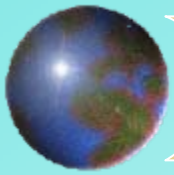
Contract warehousing

- Contract warehousing combines characteristics of private and public operations.
- Benefits: lower cost, expertise, flexibility, economies of scale by sharing management, labor, equipment, and information resources with multiple clients.

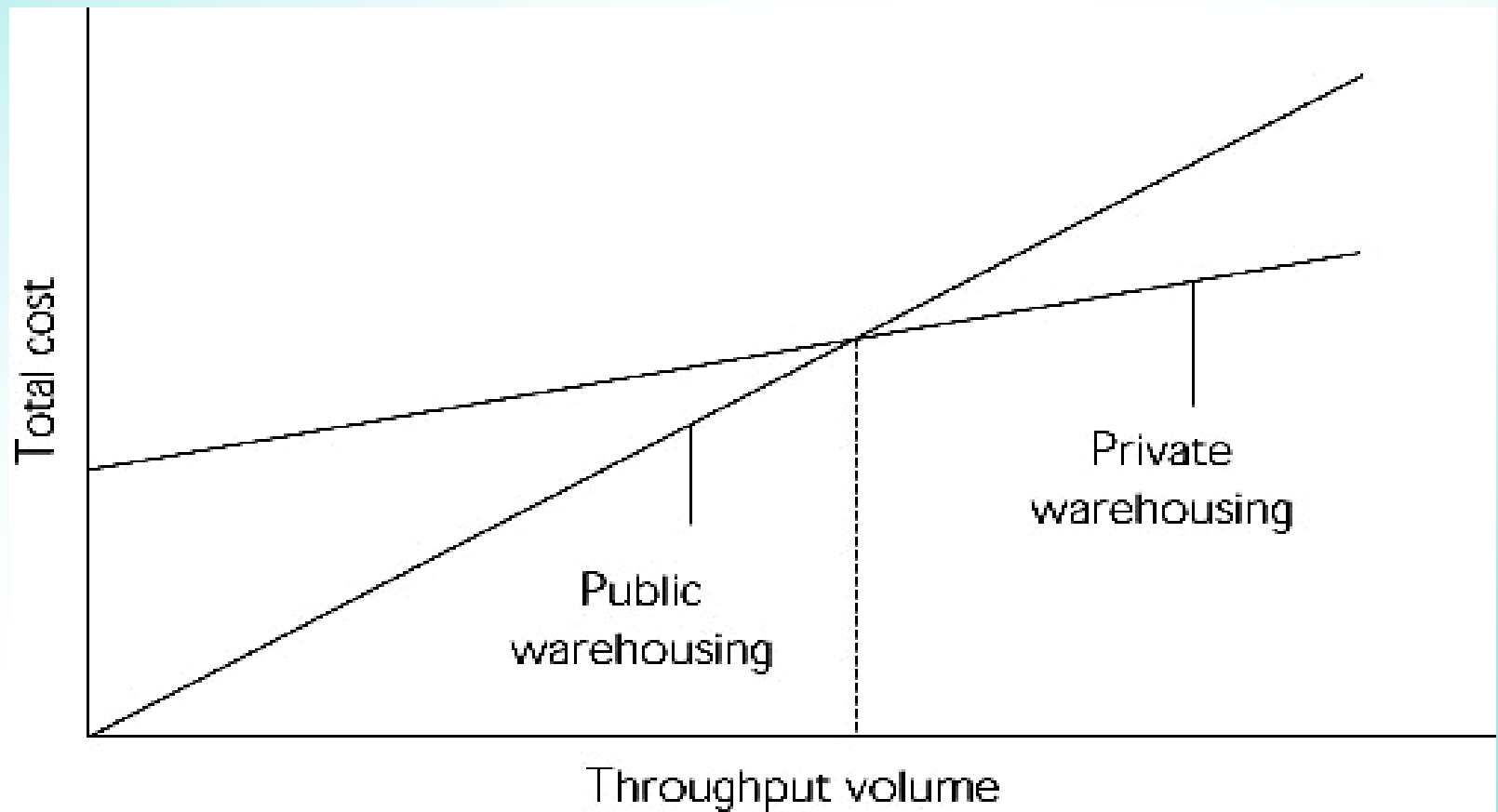


6. Warehouse decision strategy

- **The Governance Structure of Enterprise warehouse operation**
 - **Break-even method**
 - **Transaction cost economics method**
- **The numbers of warehouse**
 - **The number of warehouse and logistics cost**
 - **The number of warehouse and inventory level**



Break-even method





Total Operation Cost and Enterprises' Vertical Boundary Based on TCE

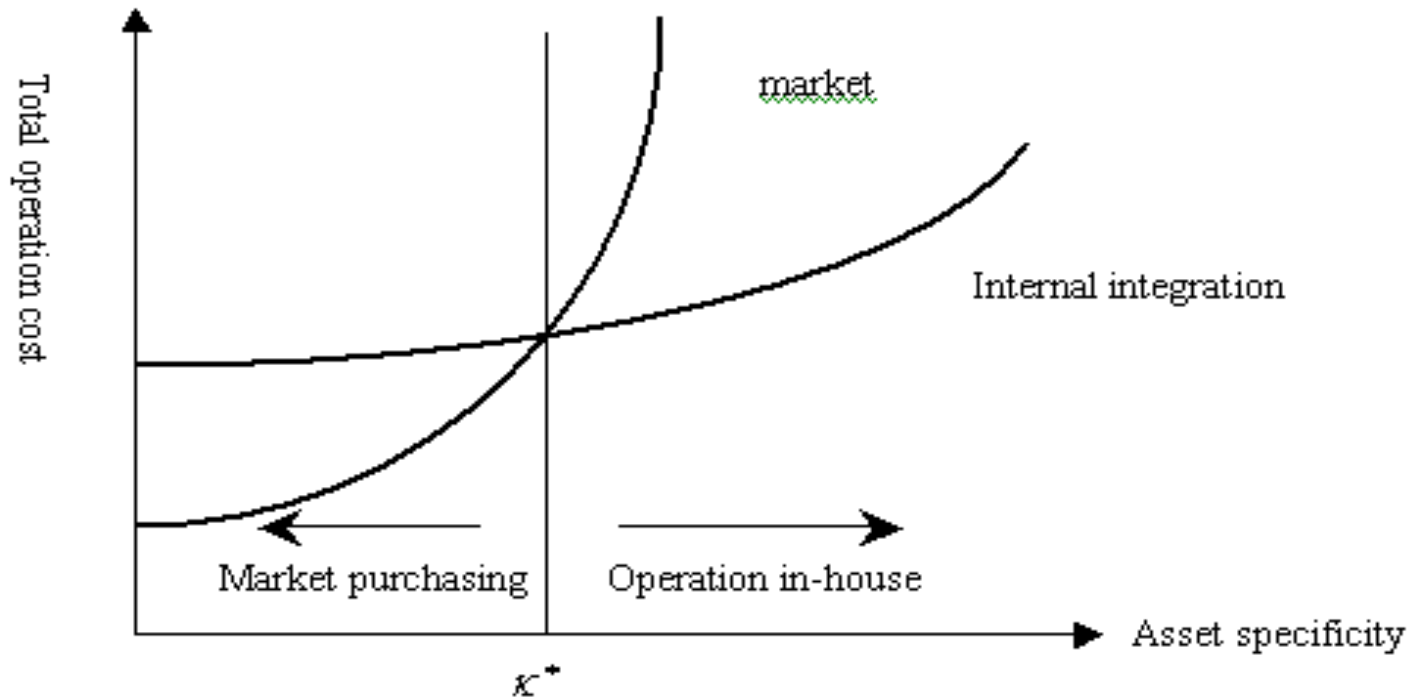
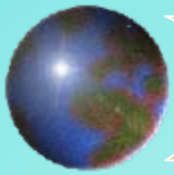


Figure 1. Total operation cost and enterprises' vertical boundary



Cost Performance of Market and Enterprises' Vertical Boundary

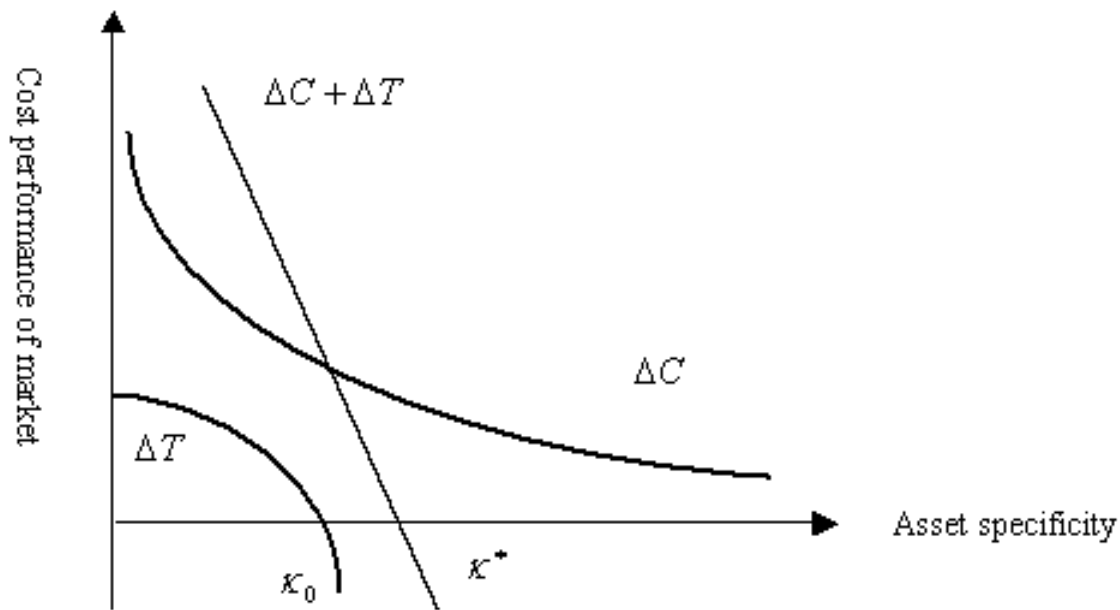
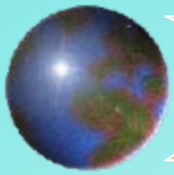


Figure 2. Cost performance of market and enterprises' vertical boundary



Cost Performance of Outsourcing and the Change of Vertical Boundary

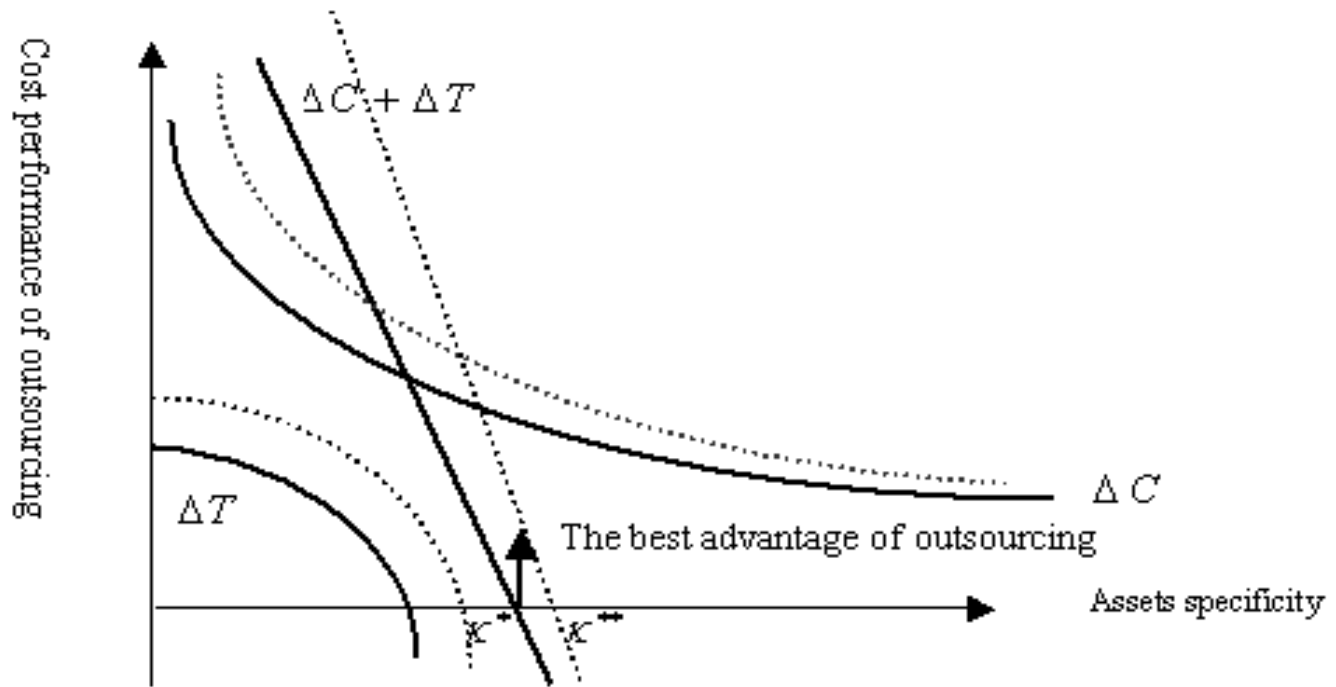
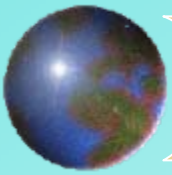


Figure 3 cost performance of outsourcing and the change of vertical boundary



Total Operation Cost and Outsourcing Area

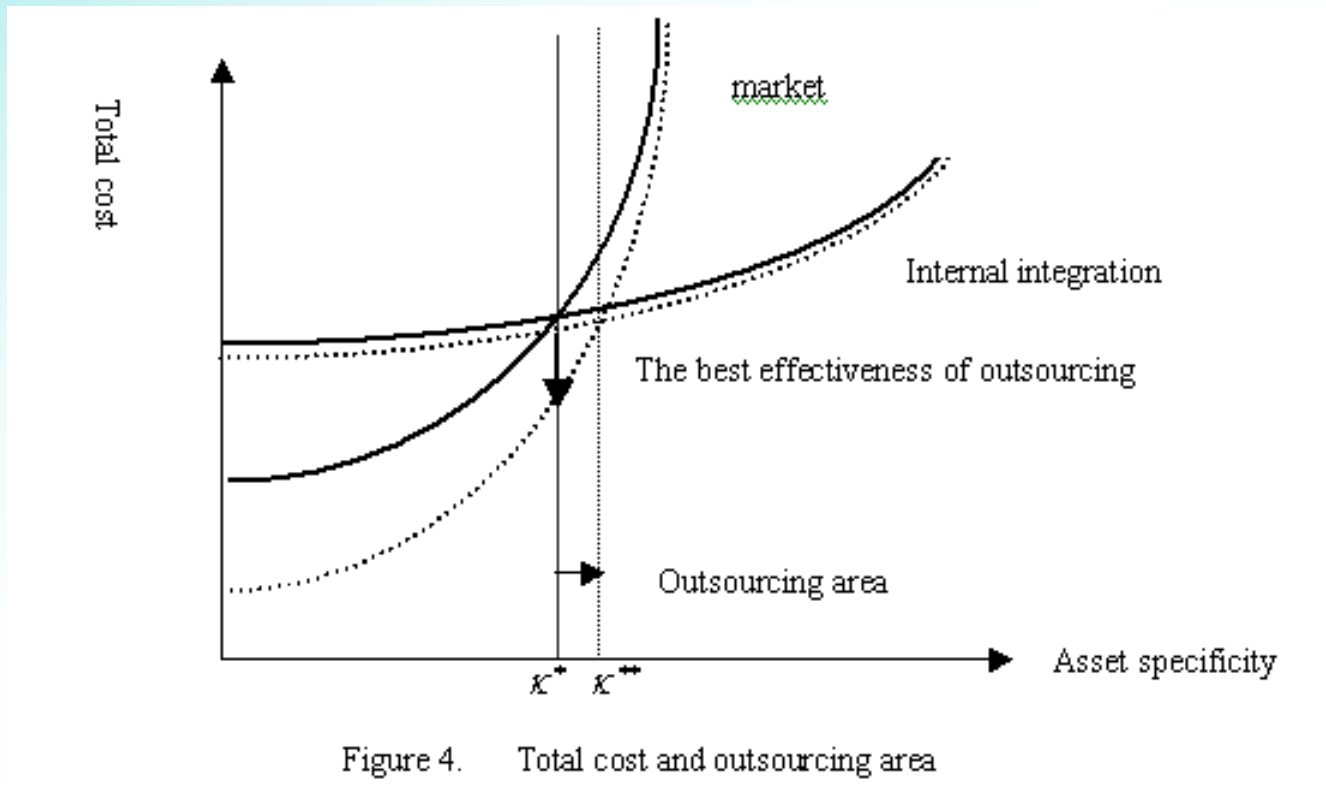
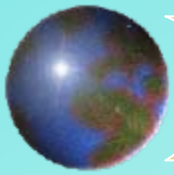
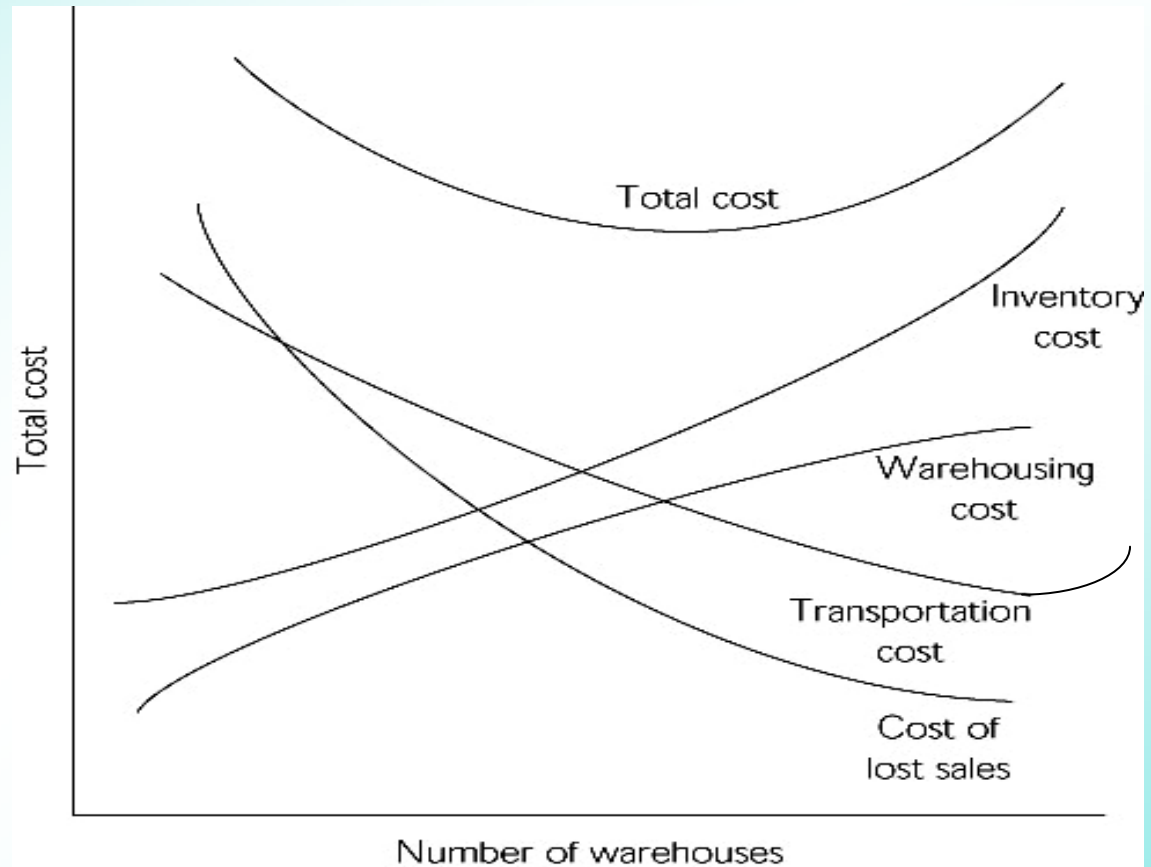
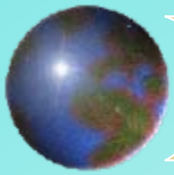


Figure 4. Total cost and outsourcing area



Numbers of warehouse and logistics cost





Numbers of warehouse and inventory level

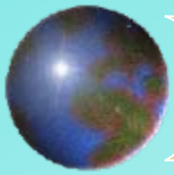
$$X_2 = X_1 \times \sqrt{n_2 / n_1}$$

X_2 represent the future inventory level

X_1 represents the current inventory level

n_2 represents the future warehouse numbers

n_1 represents the current warehouse numbers

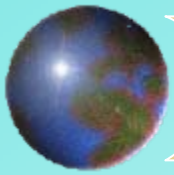


Example :

- Current number of warehouse is 8, the inventory level is 40, 000 units
- The number of warehouse is reduced to 2, how about the new inventory level?

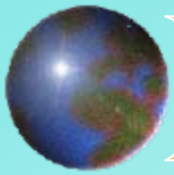
$$X_2 = 40,000 \times \sqrt{2/8}$$

$$X_2 = 20,000 \text{ units}$$



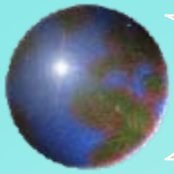
7. Warehouse planning and management

- Site selection
- Warehouse design and layout
- Product mix
- Warehouse management system



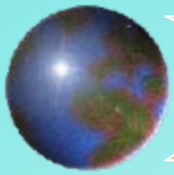
Warehouse site selection

- **The first is the location of the firm's various markets.**
- **The second is of the location of customers and suppliers.**
- **Other important factors:**
 - **land cost;**
 - **labor rates;**
 - **transportation services;**
 - **taxes**
 - **security;**
 - **availability of utilities.**

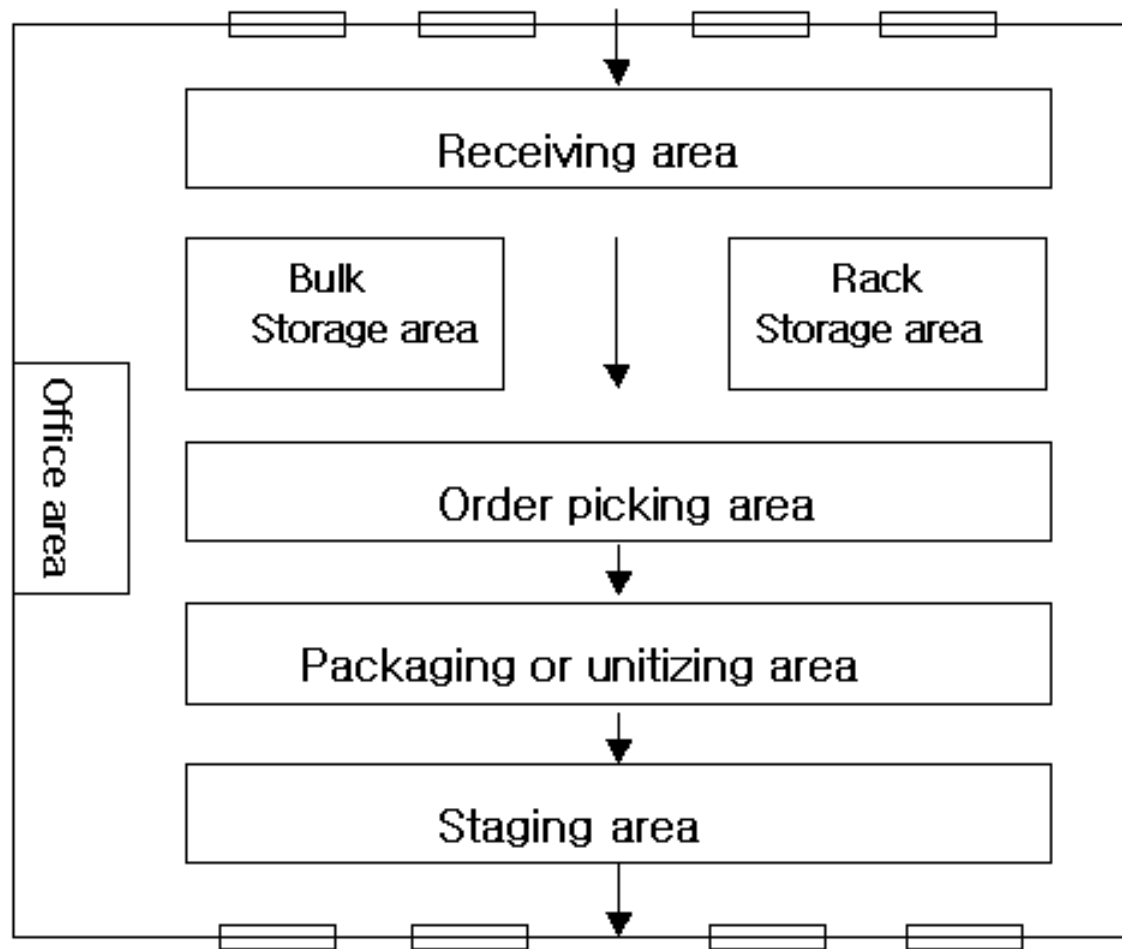


Warehouse design and layout

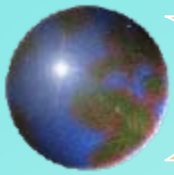
- **Number of floors**
- **Cube utilization**
- **Product flow**
- **productivity measurement.**



Basic warehouse design

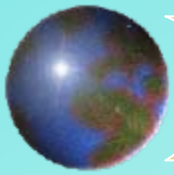


Product flow →



Warehousing management system

- safety and maintenance;
- security systems;
- personal training.



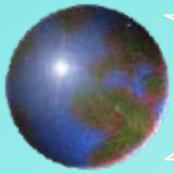
8. Materials handling

● Objectives

- To eliminate handling wherever possible;
- To minimize travel distance;
- To minimize goods in process;
- To provide uniform flow free of bottlenecks;
- To minimize losses from wasting, breaking, spoiling and thieving

● System

● Packaging and materials handling



Materials handling system

- **Manual system**
- **Mechanized system**
- **Automated system**



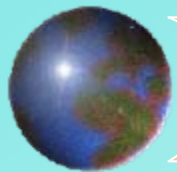
人工叉车





平衡式机械叉车





高空堆垛车





Swing Reach Trucks



双进深货架



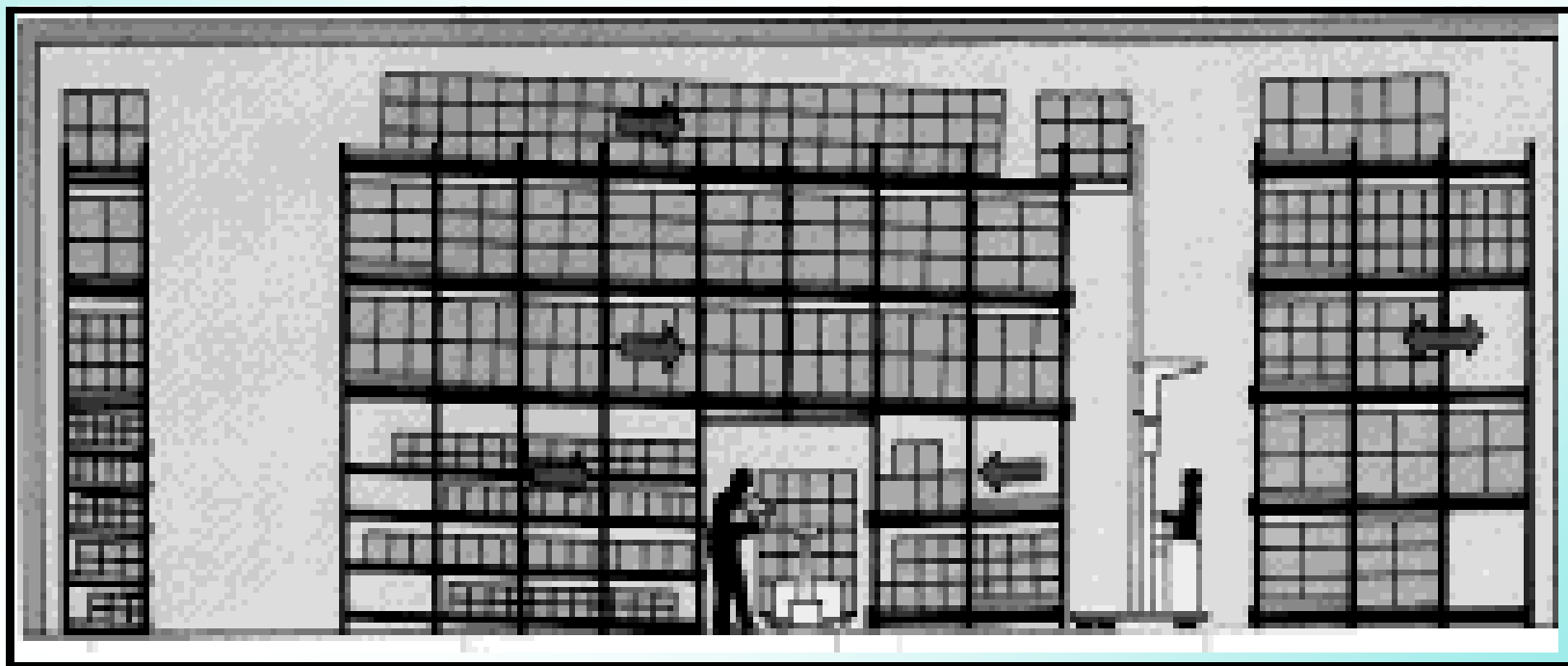


驶入式货架





滑动货架—“先进先出”





窄巷道货架





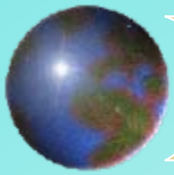
窄巷道高空拣选车





货物拣选传送带



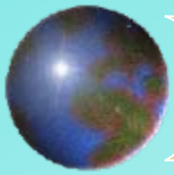


Packaging and materials handling

➤ **Marketing**

➤ **Logistics**

- **The package protects the product from damage while it is being stored or transported.**
- **Packaging can make it easier to store and move products by reducing handling and thereby material handling costs.**



Logistics equipment terms

- Order-picker trucks place the operator on an elevating platform along with the forks.
- Reach trucks operate in narrow aisles.
- Balanced lift trucks
- Order-picker conveyors
- Goods shelf (racks)
- Stereoscopic warehouse