Part 4 : Distribution & Customer support.

Ch.4 Warehousing.

Edited by Dr. Seung Hyun Lee (Ph.D., CPL)
IEMS Research Center, E-mail : lkangsan@iems.co.kr
Importance of Warehouse.

Nature and Importance of Warehouse.

Definition of Warehouse.

- We often define warehousing as the storage of goods. Broadly interpreted, this definition includes a wide spectrum of facilities and locations that provide warehousing, including the storage of iron ore in open fields; the storage of finished goods in the production facility; and the storage of raw materials, industrial goods, and finished goods while they are in transport.
Nature and Importance of Warehouse.

Roles of Warehouse.

- In a macro-economic sense, warehousing performs a very necessary function. It creates time utility for raw materials, industrial goods, and finished products. The proximity of market-oriented warehousing to the customer allows a firm to serve the customer with shorter lead times.

- More important, warehousing increases the utility of goods by broadening their time availability to prospective customers. In other words, by using warehouses, companies can make goods available when and where customer demand them. This warehousing function continues to be increasingly important as companies and industries use customer service as a dynamic, value-adding competitive tool.
Importance of Warehouse.

Nature and Importance of Warehouse.

**Roles of Warehouse in Logistics System.**

<table>
<thead>
<tr>
<th>Value-Adding Roles</th>
<th>Trade-Off Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>· Consolidation.</td>
<td>Transportation.</td>
</tr>
<tr>
<td>· Product mixing.</td>
<td>Order Filling.</td>
</tr>
<tr>
<td>· Service.</td>
<td>Lead Time, Stockouts.</td>
</tr>
<tr>
<td>· Contingency protection.</td>
<td>Stockouts.</td>
</tr>
<tr>
<td>· Smooth operation.</td>
<td>Production.</td>
</tr>
</tbody>
</table>
Some Activities of Warehouse.

Transportation Consolidation.

(a) INBOUND LOGISTICS SYSTEM

- Supplier
- Supplier
- Supplier
- Supplier

Warehouse

Volume shipment

Plant

(b) OUTBOUND LOGISTICS SYSTEM

- Plant
- Plant
- Plant

Volume shipment

Warehouse

Warehouse

Market

Market

[Coyle, pp281-335]
Some Activities of Warehouse.

Product & Supply Mixing.

[Coyle, pp281-335]
Some Activities of Warehouse.

Cross Docking.

Under a cross docking system, palletloads can be moved directly across the warehouse floor from receiving to shipping (left). Boxes, however, first must pass through a sortation system (right).

Some Activities of Warehouse.

[Coyle, pp281-335]

Other Activities.

Service.

- A fourth warehouse function is to provide service. The importance of customer service is obvious. Having goods available in a warehouse when a customer places an order, particularly if the warehouse is in reasonable proximity to the customer, usually leads to customer satisfaction and enhances future sales.

Contingencies.

- A fifth warehousing is protection against contingencies such as transportation delays, vendor stockouts, or strikes.

Smoothing.

- A sixth warehousing function is to smooth operations or decouple successive stages in the manufacturing process. Seasonal demand and the need for a production run long enough to ensure reasonable cost and quality are examples of smoothing - that is, preventing operations under overtime conditions at low production levels.
Basic Warehouse Decisions.

- Ownership
  - Private
  - Public
  - How many
    - Centralized
    - Decentralized
      - What size
      - Where (location)
      - Interior layout
      - What products, Where

[Coyle, pp281-335]
Basic Warehouse Decisions.

**Public vs. Private Warehouse.**

- The public warehouse is all variable cost. As the throughput volume in the warehouse increase, the company has to rent space. This space is available at a specific charge per square foot or per cubic foot.

- The private warehouse, on the other hand, has a fixed cost element, which we can attribute to elements such as property taxes and depreciation in its cost structure. The variable portion of the warehouse operating cost would usually increase more slowly than the cost of the public warehouse because of the profit and the cost of marketing the public facility.
**Basic Warehouse Decisions.**

**Public vs. Private Warehouse.**

<table>
<thead>
<tr>
<th>Firm Characteristics</th>
<th>Private</th>
<th>Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughout volume</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Demand variability</td>
<td>Stable</td>
<td>Fluctuating</td>
</tr>
<tr>
<td>Market density</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Special physical control</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Customer service required</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Security requirements</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Multiple use needed</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Basic Warehouse Decisions.

Characteristics of Public Warehouse.

- General merchandise warehouses for manufactured goods.
- Refrigerated of cold storage warehouses.
- Bonded warehouses.
- Household goods and furniture warehouses.
- Special commodity warehouses.
- Bulk storage warehouses.

Public Warehouse Rates.

- Value.
- Fragility.
- Damage to other goods.
- Volume and regularity.
- Weight density.
- Service.
Basic Warehouse Decisions.

**Contract Warehouse.**

- Contract warehousing is a customized version of public warehousing in which an external company provides a combination of logistics services that the firm itself has traditionally provided.

- The contract warehousing company specializes in providing efficient, economical, and accurate distribution services. These warehouses are designed to adhere to higher standards and specialized handling needs for products such as pharmaceuticals, electronics, and high value manufacturing goods.
Basic Warehouse Decisions.

No. of Warehouses.

[Coyle, pp281-335]
Basic Warehouse Decisions.

Warehouse Location Analysis.

- Edgar Hoover Macro Model.
  - Market positioned strategy locate warehouses nearest to the final customer.
  - Production positioned strategy locate warehouse close to sources of supply or production facilities.
  - Intermediately positioned strategy places warehouses at a midpoint between the final customer and the producer.

- Von Thunen's Model.
  - The optimal location would have to be the one that minimized transportation expenditure.

- Weber's Model.
  - The optimal site was the location that minimized "total transportation costs - the costs of transferring raw materials to the plant and finished goods to the market."
Basic Warehouse Decisions.

Warehouse Location Analysis.

- Hoover's Model.
  - Hoover included the factors of demand and profitability in the location decision. He examined both cost and demand elements of location analysis.

- Greenhut's Model.
  - The optimal facility location was the one that maximized profits.

- Center-of-Gravity Approach.
  - It locates a warehouse or distribution center at a point that minimizes transportation costs for products moving between a manufacturing plant and the market.
Basic Warehouse Decisions.

Warehouse Location Analysis: Qualitative Factors.

- Quality and variety of transportation carriers servicing the site.
- Quality and quantity of available labor.
- Labor rates.
- Cost and quality of industrial land.
- Potential for expansion.
- Tax structure.
- Nature of the community environment.
- Costs of construction.
- Cost and availability of utilities.
- Cost of money locally.
- Local government tax allowances.
## Basic Warehouse Decisions.

**Centralized vs. Decentralized.**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Centralized</th>
<th>Decentralized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substitutability</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Product Value</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Purchase Size</td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Special Warehousing</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Product Line</td>
<td>Diverse</td>
<td>Limited</td>
</tr>
<tr>
<td>Customer Service</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

[Coyle, pp281-335]
Warehousing Operation.

[Coyle, pp281-335]
Storage.

Some Storage Strategy.

- **Randomized Storage.**
  Randomized, or floating slot, storage place items in the closest available slot, bin or rack. Products are then retrieved on a first-in, first-out (FIFO) basis. This approach maximizes space utilization, although it requires longer travel times between order-picking locations. Randomized systems often employ a computerized automatic storage and retrieval systems (AS/RS), which minimizes labor and handling costs.

- **Dedicated Storage.**
  In dedicated, or fixed-slot, storage, products are stored in permanent locations within a warehouse. Various location criteria commonly used to locate stock: popularity, unit size, cube, compatibility, complementarity, and so on.
Warehousing Operation.

Storage.

**Some Storage Strategy.**

- **Popularity.**
  The popularity criterion locates popular items near the shipping area and the unpopular items always from the shipping. By this method, the order pickers travel a shorter distance to pick the most popular items being ordered, thereby reducing the time required to pick orders.

- **Unit Size.**
  The unit size criterion that small-size items be located near the shipping area and larger-size items be placed farther away from the shipping area. By locating smaller-size items near the shipping area, more items can be stored near the shipping area, which reduces the order picker travel distance and order-picking time.
Warehousing Operation.

Storage.

Some Storage Strategy.

- **Cube.**
  The cube criterion is a variation of unit size in that the items with smaller total cube space requirements are located near the shipping area.

- **Compatibility.**
  Compatibility refers to how well products may be stored together. For example, pharmaceuticals cannot be stored with bagged agricultural chemicals.

- **Complementarity.**
  Complementarity refers to how often products are ordered together and therefore stored together. Computer disk drives, CD-ROMs, and monitors; pens and pencils; and desks and chairs are examples of complementarity products that usually stored close to each order.
Warehousing Operation.

Warehouse Management System.

Definition.

- Computer software systems assist in the accurate management of the receiving, put-away, picking, packing, shipping, storage location, work planning, warehouse layout, and analysis activities.

- The benefits of WMS are significant. Improved warehouse productivity, efficiency, and accuracy are the obvious benefits.

- By keeping track of item locations in the warehouse, the WMS reduces wasted efforts associated with warehouse personnel "hunting" for an item. This improves labor's productivity, reduces the number of personnel required, and improves the order-picking accuracy.

- In addition, WMS technology provides improved managerial control and effectiveness though point-of-work confirmation, accountability, performance measurement, and what-if scenario planning.
Warehousing Operation.

[Coyle, pp281-335]
Warehousing Operation.

Warehouse Layout Principles.

**Some Principles.**

- First, use a one-story facility wherever possible, since it usually provides more usable space per investment dollar and usually is less expensive to construct.

- Second, use straight-line or direct flow of goods into and out of the warehouse to avoid backtracking and inefficiency.

- A third principle is to use efficient materials-handling equipment and operations.

- A fourth principle is to use an effective storage plan in the warehouse. In other words, the firm must place goods in the warehouse in such a way as to maximize warehouse operations and avoid efficiencies.

- A fifth principle of good layout is to minimize aisle space within the constraints that size, type, and turning radius of materials-handling equipment impose.

- A sixth principle is to make maximum use of the building's height - that is, to utilize the building's cubic capacity effectively. This is usually requires integration with materials handling.
Performance Check.

1. What are some factors that influence a firm's warehousing policies?
   I. The firm's philosophy and capital availability.
   II. Product characteristics such as size and perishability.
   III. Competition and seasonality of demand and economic conditions.
   IV. Technology, efficiency program, and e-commerce.


2. There are six types of public warehouses. Which one is NOT one of those?
   A. General merchandise warehouse.
   B. Common or docking warehouse.
   C. Refrigerated or cold storage warehouse.
   D. Bonded warehouse.
Performance Check.

3. Warehousing has some basic functions, which of the following may be included as one of them?
   I. Movement.
   II. Storage.
   III. Information transfer.
   IV. Efficiency motivation.


4. Which of the following is NOT an advantage of public warehousing?
   A. Conversion of capital.          B. Reduced risk.
Performance Check.

5. The task of order picking can be grouped into four categories, which of the following is NOT one of those four?
   A. Order picking.                                B. Horizontal picking.
   C. Batch picking.                               D. Zone picking.

6. Which of the following is NOT one of the most important factors determining the size of a firm's warehouses?
   A. Sizes of markets served.
   B. Number of segments served via competitors.
   C. Material handling system used.
   D. Stock layout and throughput requirements.
Performance Check.

7. All of the following situations increase the need for storage space, EXCEPT:
   I. A decrease in sales.
   II. Elimination of distributors.
   III. Shorter life cycles.
   IV. Greater forward buying.
   V. Market expansion.

A. I  B. I, II  C. I, II, III  D. I, III

8. A firm has originally two distribution centers. As time pass, they will increase their distribution centers step by step. We can expect which of the following?
   A. The cost of truckload shipments to the distribution centers to decrease.
   B. Customer complaint.
   C. Eventually, as more distribution centers are added, the marginal savings decrease.
   D. The total cost of transportation to increase.
9. In operating a warehouse, the major operating cost is:
   A. Fork truck maintenance
   B. System costs
   C. Labor
   D. Capital costs

10. The purpose of holding inventory in distribution centers is to:
   A. Improve customer service by keeping stock near the customers
   B. Reduce transportation and warehousing costs
   C. Minimize inventory investment
   D. Increase inventory turns through the network
11. Receiving, transfer, put-away, order picking, order selection, cross docking, and shipping are all part of which basic function of warehousing?
   A. Movement.
   B. Storage.
   C. Information Transfer.
   D. Customer Service.

12. Storage facilities authorized to operate as bonded warehouses:
   A. Are rarely collocated with field warehouses.
   B. Must be designed as public warehouses to be accorded status as bonded warehouses.
   C. Provide storage based on a covenant of trust with a governmental agency for custody and accountability of the consigned goods.
   D. Provide storage of taxable merchandise until taxed are collected from the ultimate recipients.
13. Public warehouses are favored over private warehouses in all the following situations, EXCEPT.
   A. Markets are widely dispersed.
   B. Demand for stored products is relatively stable.
   C. Inbound and outbound shipments involve a multiplicity of transportation.
   D. Investment in facilities are negligible.

14. A commercial storage site would be located near a production facility when:
   A. Responsiveness and service to the customers are predominant priorities.
   B. There is broad diffusion of market centers.
   C. The corporate goal is to minimize overall distribution costs.
   D. Additional processing of product source material is required.
Performance Check.

15. Enlargement of the area of coverage by a warehouse would likely:
   A. Reduce storage costs per unit of product.
   B. Reduce transportation costs per unit of product.
   C. Increase overall inventory costs.
   D. Reduce delivery times.
Performance Check.

Solutions:

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15
D  B  B  C  B  B  A  C  C  A  A  C  B  D  A