Retail
Domain Academy

Warehouse Management

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Warehousing - Basics

What is a warehouse?

- A warehouse is a large building where raw materials or manufactured goods are stored and where they may be catalogued, shipped or received depending upon the type.
- Warehouses are used by manufacturers, importers, exporters, wholesalers, transport businesses, customs, etc.
- They are usually large plain buildings in industrial areas of cities and towns and villages.
- Warehouses usually have loading docks to load and unload goods from trucks.
- Sometimes warehouses are designed for the loading and unloading of goods directly from railways, airports, or seaports.

Amazon.com warehouse

What is a warehouse? (Cont..)

- They often have cranes and forklifts for moving goods, which are usually placed on ISO standard pallets loaded into pallet racks.
- Stored goods can include any raw materials, packing materials, spare parts, components, or finished goods associated with agriculture, manufacturing, or commerce.

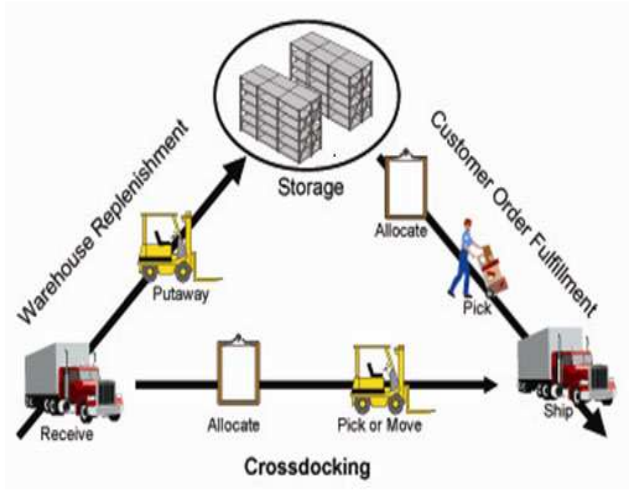
Evolution of strategic warehousing

- Warehouses were once viewed as a necessary evil, used to coordinate product supply with customer demand.
- Warehousing shifted from passive storage to strategic assortment.
- Contemporary view is the warehouse functions to mix inventory assortments to meet customer requirements.
- Storage of products is held to a minimum.
- New age warehouses are either partially or fully automated depending on how advanced the company is.

Warehousing Types

- Various warehousing types evolved to accommodate the dynamic aspects of business.
- **Distribution center (DC)** - The warehouse facility which holds inventory from manufacturing pending distribution to the appropriate stores. Breaking bulk and making bulk are traditional functions of a DC
- In a **break-bulk facility**, large incoming loads are de-aggregated, often for product mixing and to create consolidated outbound shipments
- A **make-bulk facility or consolidation center** combines small quantities of several products into fewer, larger assortments
- **Cross-docks**

Walmart Distribution Center (DC)



Warehousing Types (Contd.)

- Cross-docks are trans shipment facilities to which trailers arrive with freight that should be sorted and loaded directly onto outbound trailers (or staged in the load position while waiting for the outbound trailer).
- The freight to each destination is consolidated from several origins. This consolidation of freight (without intermediate storage) is called cross-docking.
- Cross docking requires close synchronization of all inbound and outbound shipment movements.
- This operation is prevalent in large carriers of ground and overnight service.
- Cross-docks are attractive for two main reasons:
- Cross-docking is a way to reduce inventory holding costs, as it eliminates put-away, storage and selection processes
- For Less-Than-Truckload (LTL)** and small package carriers, cross-docking is a way to reduce transportation costs

Warehousing Types (Contd.)

- In reality, pure cross-docking is rare outside of transportation hubs and hub-and-spoke** type distribution networks.
- Many cross-docking operations require large staging areas where inbound materials are sorted, consolidated, and stored until the outbound shipment is complete and ready to ship.
- This staging may take hours, days, or even weeks in which case the ‘staging area’ is essentially a ‘warehouse’.

Common Warehouse Terms

- **Case** — describes a unit of measure and the way multiple physical units are packaged. A case would typically be a sealed corrugated carton where a standardized quantity (greater than one) of a specific item is packed
- **Forklift (also called lift truck, fork truck, forklift truck, or tow-motor)** — is a powered industrial truck used to lift and transport materials
- **Pallet** — sometimes called a **skid**, is a portable platform designed to allow a forklift or pallet jack to lift, move, and store various loads. Most pallets are made from wood, but pallets are also made from plastic, steel, and even paper-based materials
- **Pallet racking** — is a material handling storage aid system designed to store materials on pallets.

Forklift

Wooden Pallet

Pallet Rack

Common Warehouse Terms (Contd.)

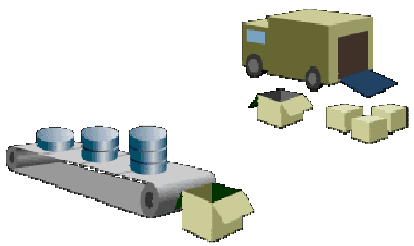
- **Skid**—a portable platform designed to allow a forklift, pallet jack, or other material handling equipment lift, move, and store various loads. A skid is similar to a pallet but does not have bottom deck boards. A skid is preferred over a pallet when used with equipment that would have problems with the bottom deck boards. Though not technically correct, the terms Skid and Pallet are often used interchangeably
- **Slot** — the physical space where an item is stored. Examples of slots would include a parts bin on a shelf, a pallet location in pallet rack, or a storage lane where multiple pallets of an item are stacked on the floor

Panoramic View of J&J Amusements Warehouse in Salem, Oregon USA
J&J is manufacturer of go-karts and bumper boats in the amusement industry

Warehousing At-a-Glance

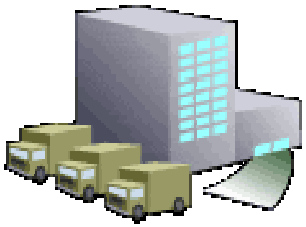
- Warehousing consists of four main process areas:
- **Inbound (Sourcing)** – Handling of goods coming into the facility
- **Internal Processing** (Processing, Manufacturing) - All processes associated with the internal handling of the inventory
- **Outbound** - Reverse of the receiving process and has a similar set of possible transaction sources
- **Reverse logistics** (returns, recycling, etc.)

Inbound



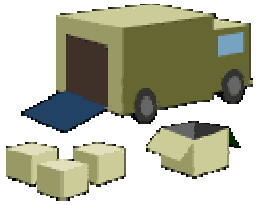
- **Purchases**
- **Manufacturing / Assembly**
- **Transfers**
- **Outside Processing**

Internal Processing



- **Pick**
- **Pack**
- **Inspection**
- **Count**
- **Assembly**
- **Storage**
- **Move**
- **Replenish**

Outbound



- **Customer Shipments**
- **Vendor Returns**
- **Transfers**
- **Outside Processing**

Warehousing - Benefits

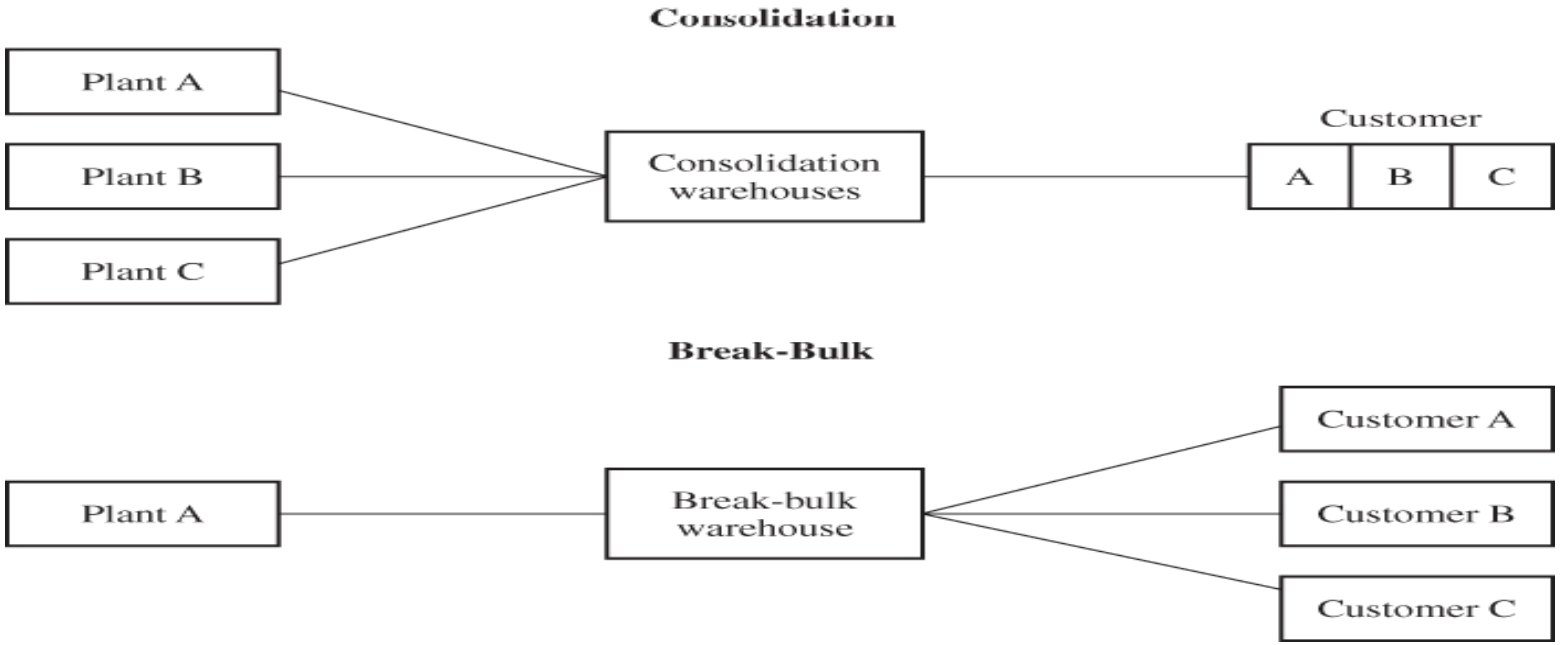
Warehousing - Benefits

- **Economic benefits** of warehousing occur when overall logistics costs are reduced
- Consolidation and break-bulk
- Sorting – Cross Docking, Mixing, Order Assembly
- Seasonal storage
- Reverse logistics

- **Service benefits** are justified by sales improvements that more than offset added cost
- Spot-stocking
- Assortment/Full line stocking
- Production Support
- Market Presence
- Value-added services

WH Economic Benefits - Consolidation & break-bulk

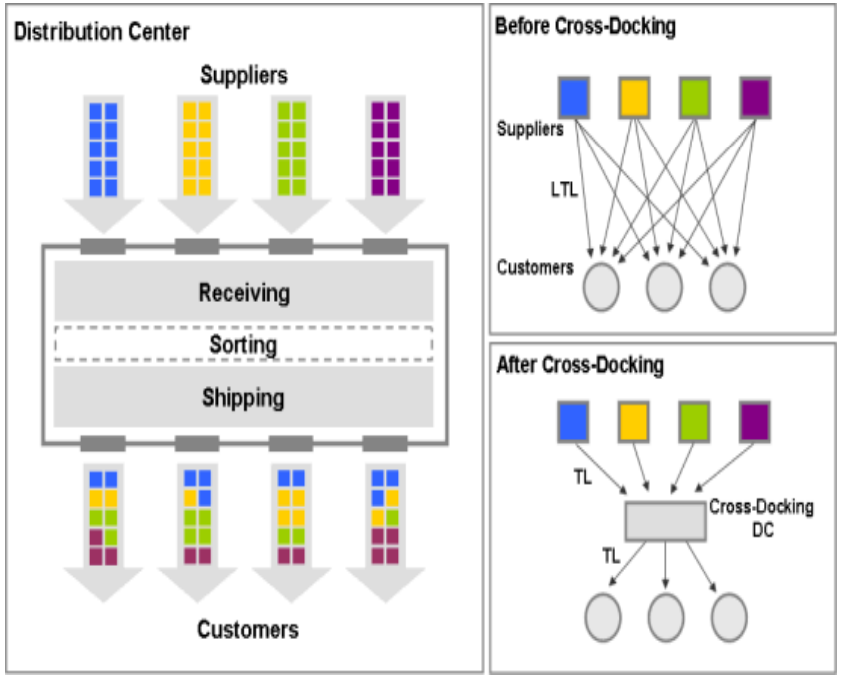
- **Consolidation and break-bulk** reduce transportation cost
- **Consolidation** occurs when a warehouse receives materials from a number of sources and combines them into exact quantities for a specific destination
- **Break-bulk** occurs when a warehouse receives a single large shipment and arranges for delivery to multiple destinations



WH Economic Benefits - Sorting

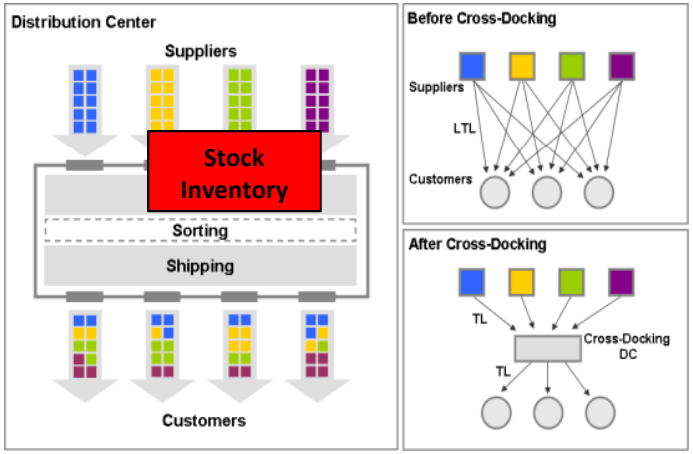
- Sorting involves reconfiguring freight as it flows from origin to destination
- Cross Docking
- Mixing
- Oder Assembly

- **Cross-docking** combines inventory from multiple origins into a pre-specified assortment for a specific customer. Cross-docking is used extensively by retailers to replenish store inventories
- Products are received, selected, repackaged, and loaded for shipment without storage
- Successful cross-docking is highly dependent on information technology



WH Economic Benefits – Sorting (Contd.)

- **Mixing** combines inventory from multiple origins but also adds items that are regularly stocked at the mixing warehouse
- In a typical mixing situation, truckloads of products are shipped from manufacturing plants to warehouses.
- Mixing is usually performed at an intermediate location between origin and destination.
- Upon arrival at the mixing warehouse, factory shipments are unloaded and the desired combination of each product for each customer or market is selected.
- Each large shipment enjoys the lowest possible transportation rate.
- When plants are geographically separated, overall transportation charges and warehouse requirements can be reduced by mixing.



WH Economic Benefits – Sorting (Contd.)

- **Assembly** occurs when products or components from second-tier suppliers are assembled by a warehouse located near manufacturing plant
- Common assembly processes are packaging and color customizing
- Assembly supports manufacturing operations

Amazon Warehouse Assembly Line

Assembly line in a California auto-manufacturing plant

WH Economic Benefits

Seasonal storage allows production efficiencies within the constraints of seasonality

- Seasonal storage provides direct benefit by accommodating production or demand
- Seasonal production include agricultural products
- Seasonal demand includes lawn furniture and toys

Reverse logistics include activities supporting

- Returns management (Recalls or product that did not sell)
- Remanufacturing and repair (Repairing / refurbishing equipment)
- Remarketing (Selling used equipment)
- Recycling
- Disposal

WH Service Benefits

- **Spot-stocking** is the positioning of inventory for seasonal or promotional demand.
- A selected amount of a firm's product line is placed or ‘spot stocked’ in a warehouse to fill customer orders during a critical marketing period.
- In particular, manufacturers with limited or highly seasonal product lines are partial to this service.
- Utilizing warehouse facilities for stock spotting allows inventories to be placed in a variety of markets adjacent to key customers just prior to a maximum period of seasonal sales.
- Following the sales season, the remaining inventory is withdrawn to a central warehouse.
- Rather than placing inventories in warehouse facilities on a year-round basis or shipping directly from manufacturing plants, delivery time can be substantially reduced by advanced inventory commitment to strategic markets.

WH Service Benefits (Cont..)

- In addition, significant savings in warehousing and transportation costs could be achieved for the manufacturer/client.
- **Example**: During Chinese new year period, manufacturer of pineapple tarts usually spot stock near local retail stores.
- After Chinese new year period, such spot stocking would be reduced or eliminated.

WH Service Benefits (Cont..)

- **Assortment/Full line stocking** provides one-stop shopping capability for product combinations from multiple suppliers.
- It creates assortments representing multiple products from different manufacturers.
- Example: an athletic wholesaler would stock products from a number of clothing suppliers so that customers can be offered assortments or special assortments as specified by customers.
- Example: the wholesaler would create a specific team uniform including shirt, pants, and shoes.

WH Service Benefits (Cont..)

- **Spot Stock Vs. Assortment**
- The differential between stock spotting and complete line assortment is the degree and duration of warehouse utilization.
- A firm following a stock spotting would typically warehouse a narrow product assortment and place stocks in a large number of small warehouses dedicated to specific markets for a limited time period.
- Distribution assortment warehouse usually has a broad product line, is limited to a few strategic locations, and is functional year-round.
- The combined assortments also allow larger shipment quantities, which in turn reduce transportation cost.

WH Service Benefits (Cont..)

- **Production support** warehousing provides a steady supply of components and materials to assembly plants.
- Safety stocks on items purchased from outside vendors may be justified because of long lead times or significant variations in usage.
- The operation of a production support warehouse is to supply or ‘feed’ processed materials, components, and subassemblies into the assembly plant in an economic and timely manner.

WH Service Benefits (Cont..)

- **Market Presence**
- While a market presence benefit may not be so obvious, it is often cited by marketing managers as a major advantage of local warehouses.
- The market presence factor is based on the perception or belief that local warehouses can be more responsive to customer needs and offer quicker delivery than more distant warehouses.
- As a result, it is also thought that a local warehouse will enhance market share and potentially increase profitability.

WH Service Benefits (Cont..)

- **Value-added services** include any work that creates a greater value for customers.
- Ex: Customer returns, home delivery, pick/pack, repair/refurbish, specialty packaging, store support/Direct Store Delivery (DSD)*, RFID tag application

Warehousing Alternatives

Warehousing Alternatives (Warehouse Types)

- There are three warehousing alternatives available, based on ownership arrangements.
- The decision as to which warehousing strategy best fits an individual firm is primarily financial.
  - Private Warehouse - Operated by the company whose goods are stored in the building. Building may be owned or leased.
  - Public Warehouse - Operated by a third party that stores goods for multiple shippers/owners.
  - Contract Warehouse - Owned and operated by a third party that dedicates resources to the company owning the goods in storage.
- Public warehouse operators generally offer relatively standardized services to all clients - such as storage, handling, and transportation - on the basis of a fixed or variable fee.
- Contract warehousing combines elements of private and public operations. Usually a long-term relationship or contract between a firm and the warehousing owner/operator exists for a specified period of time.

Public Warehouses - Classification

On the basis of the range of specialized operations performed, public warehouses are classified as:

- General merchandise - designed to handle general package commodities such as paper, small appliances, and household supplies
- Refrigerated (either frozen or chilled) - handle and maintain food, medical items, and chemical products with special temperature requirements
- Commodity - designed to handle bulk material or items with special handling considerations, such as tires or clothing
- Bonded - licensed by the government or private agencies (with license from govt.) to store goods prior to payment of taxes or duties. They exert very tight control over all movements in and out of the facility since government documents must be filed with each move. For example, cigarettes are often stored in bonded warehouses prior to having the tax stamp applied.
- Household goods and furniture - designed to handle and store large, bulky items such as appliances and furniture

Other (Public) Warehouse Types

- **Government Warehouses** -These warehouses are owned, managed and controlled by central or state governments or public corporations or local authorities.
- Both government and private enterprises may use these warehouses to store their goods.
- Central Warehousing Corporation of India, State Warehousing Corporation and Food Corporation of India are examples of agencies maintaining government warehouses.
- **Co-operative Warehouses** - These warehouses are owned, managed and controlled by co-operative societies.
- They provide warehousing facilities at the most economical rates to the members of their society.

Warehousing Alternatives - Comparison

Type	Advantages	Disadvantages
Private	➢ Can be custom designed to meet the customer needs ➢ Total control over the warehousing function and its integration into the overall system ➢ Can be utilized to house other corporate functions ➢ It conveys a commitment to the marketplace	➢ High costs - initial investment and maintenance ➢ Risk of sub optimization is higher (no flexibility if demand increases or decreases) ➢ Cannot be used for other purposes as it was custom designed
Public	➢ Only utilizing and paying for the space you need ➢ More flexibility (space – resources) ➢ No capital outlay required ➢ Upkeep is the responsibility of the warehouse owner	➢ No control over the warehouse operation ➢ Costs are higher (profit and overhead for the warehouse owner) ➢ Design not optimal for the user's products or needs ➢ Administration can be more complex having to work with a third party
Contract	➢ No capital outlay required ➢ Can be custom designed 'tailored' to meet the customer needs ➢ Can offer specialized services that cannot be obtained from a public warehouse ➢ Dedicated personnel to support a given customer's need ➢ Some flexibility in resources (when shared with other customers)	➢ Somewhat less control than with company owned facility ➢ The necessity for sharing confidential company & customer information ➢ The risk of an unsatisfactory relationship before the contract period is completed

Characteristics of Ideal Warehouses

In each of these warehouses, adequate arrangements are made to keep the goods in proper conditions. However, any warehouse is said be an ideal warehouse if it possesses certain characteristics, which are given below:

- Warehouse should be located at a convenient place near highways, railway stations, airports and seaports where goods can be loaded and unloaded easily
- Mechanical appliances should be there to loading and unloading the goods. This reduces the wastages in handling and also minimizes handling costs
- Adequate space should be available inside the building to keep the goods in proper order
- Warehouses meant for preservation of perishable items like fruits, vegetables, eggs and butter etc. should have cold storage facilities
- Proper arrangement should be there to protect the goods from sunlight, rain, wind, dust, moisture and pests.

Characteristics of Ideal Warehouses (Cont..)

- Sufficient parking space should be there inside the premises to facilitate easy and quick loading and unloading of goods.
- Round the clock security arrangement should be there to avoid theft of goods.
- The building should be fitted with latest fire-fighting equipments to avoid loss of goods due to fire.

Warehousing Strategies

- A management decision to utilize private, contract or public warehousing (or some combination) flows from some analysis of the costs and benefits associated with each.

Steps	Factors to consider
1) Assess the ability to perform the warehousing in-house	Customer service requirements, Cost, Control, Convenience, Internal capacity, Internal capabilities, Control of quality etc.
2) Compare private warehousing with service externally	Ability to meet customer needs, costs, control, secrecy, market conditions, supply assurance etc.
3) When decided to outsource the storage activity	The choice is between public and Contract warehousing. Factors to consider are cost, control, additional logistics services required, duration of need etc.

Warehouse within a company/supply chain

Functions of Warehouses

Warehouses perform the following functions:

- **Storage of goods** - The basic function of warehouses is to store large stock of goods from the time of their production or purchase till their consumption or use.
- **Protection of goods** - A warehouse provides protection to goods from loss or damage due to heat, dust, wind and moisture, etc.
- It makes special arrangements for different products according to their nature.
- It cuts down losses due to spoilage and wastage during storage.
- **Risk bearing** - The risk of loss or damage to goods in storage is borne by the warehouse keeper.
- Since it is bound to return the goods in good condition, the warehouse becomes responsible for any loss, theft or damage, etc.
- Thus, it takes all precautions to prevent any mishap.

Functions of Warehouses (Cont..)

- **Financing** - When goods are deposited in any warehouse, the depositor gets a receipt, which acts as a proof about the deposit of goods.
- The warehouses can also issue a document in favor of the owner of the goods, which is called warehouse-keeper's warrant.
- This warrant is a document of title and can be transferred by simple endorsement and delivery.
- So while the goods are in custody of the warehouse-keeper, the businessmen can obtain loans from banks and other financial institutions keeping this warrant as security.
- **Processing** - Certain commodities require processing to make them consumable.
- For example, paddy is polished, timber is seasoned, and fruits are ripened, etc.
- Sometimes warehouses also undertake these activities on behalf of the owners.

Functions of Warehouses (Cont..)

- **Grading and branding** - On request warehouses also perform the functions of grading and branding of goods on behalf of the manufacturer, wholesaler or the importer of goods.
- It also provides facilities for mixing, blending and packaging of goods for the convenience of handling and sale.
- **Transportation** - In some cases warehouses provide transport arrangement to the bulk depositors.
- It collects goods from the place of production and also sends goods to the place of delivery on request of the depositors.

Major Warehouse Operations

- **Inbound processes**
- **Receiving** (~10% of warehouse operating costs): the collection of activities involved in
  - the orderly receipt of all materials coming into the warehouse
  - unloading from the inbound transportation mode
  - verifying that the quantity and quality of the materials are as ordered
  - documenting the information required
  - disbursing materials to storage or to other organizational functions requiring them
- **Put-away** (~15% of warehouse operating costs): the act of placing merchandise to storage; it includes
  - determining and registering the actual storage location(s)
  - removing the goods from the receiving dock
  - transporting the goods to the storage area
  - moving the goods to a specific location and recording this movement

Major Warehouse Operations (Cont..)

- **Storage**: Retention of products for future use or shipment
- **Replenishment**: Relocation of materials from storage to a temporary re-supply area from which orders are filled

Major Warehouse Operations – Contd.

- **Outbound processes**
- **Processing customer orders** : This set of activities includes
  - checking that the requested material is available to ship
  - if necessary, coordinating order fulfillment with other facilities of the distribution network
  - producing the “pick” lists to guide the order picking and the necessary shipping documentation
  - scheduling the order picking and the shipping activity
- **Order-picking** (~55% of warehouse operating costs): the set of physical activities involved in collecting from the storage area the materials necessary for the fulfillment of the various customer orders, typically identified as:
  - traveling (~55% of the order picking time)
  - searching (~15% of the order picking time)
  - extracting (~10% of the order picking time)
  - documentation and other activities (~20 % of the order picking time)

Major Warehouse Operations – Contd.

- **Checking**: Checking orders for completeness (and quality of product)
- **Packing and marking**: Packaging the merchandise in appropriate shipping containers and attaching the necessary documentation / labels needed for shipping and handling
- **Staging and Consolidation**: Physically moving material from the packing zone to a shipping area based on instructions related to outbound vehicle or delivery route
- **Shipping**: The activities of
  - preparing the shipping documents (packing list, address label, bill of lading*) accumulating orders to outbound carrier
  - loading trucks (although, in many instances, this may be the carrier's responsibility)
- **Clerical/Office Administration**: All tasks associated with keeping track of items as they move into, through and out of the warehouse
- **Others**: Handling returns and performing additional value-added services supported by contemporary warehouses

Managing the material/products turns in warehouse

- Organizations use different methods to achieve the efficient flow and control of inventory and they try to ensure that items process and ship before they expire or perish.
- **First In First Out (FIFO)** - Organize inventory so that the merchandise stored first is the merchandise that is retrieved first. This method of warehouse organization is particularly effective for inventory that has perishable or date-specific qualities. Logistics companies can also use the FIFO system throughout the supply chain, including the inventory, warehousing and transportation of all material handled by the company
- **Last In First Out (LIFO)** - LIFO restocks merchandise by moving older items to the back and making room for any new items that are the same. In LIFO system, the last items stocked are the first items sold. This method is useful for merchandise that has no sell-by or expiration date. Since the company will sell the older products in the future, an organization that uses the LIFO system should control the distribution of the merchandise at timely intervals to ensure that products do not remain warehoused for excessive periods of time

Warehouse Operations-Metrics and Assessment

Measures and Metrics of WH Operations

- Warehouses are one of the most labor intensive nodes in a supply chain and they still constitute a substantial part of the supply chain costs.
- Warehouses generally measure their effectiveness through various metrics that can be grouped in one of the following categories:
- **Operational metrics** is primarily focused on the number of activities performed.
- The main focus of the operational metrics is to measure the efficiency of the material handling operations within the warehouse.
- Automation and usage of equipments and automation can help enhance operational efficiency in a warehouse.
- Examples: Number of cases received and shipped, number of picks and put-away tasks completed, units handled, dollar value of the handled merchandise, and so on.

Measures and Metrics of WH Operations (Cont..)

- **Fulfillment metrics** measures their ability to fulfill orders on time and in full.
- Response time and perfect order metrics fall in this category and consist of measuring fill-rates, on-time fulfillment, and pick and ship accuracy (right product in right quantity for right customer) at the warehouse.
- Other metrics contributing towards perfect orders, like correct invoicing and order entry is generally outside the scope of warehouse functions.
- Fulfillment metrics measure the efficacy of the inventory planning and replenishment systems for the warehouse.
- Since the inventory and replenishment planning systems can project future build-up of inventories, such data can be used directly by the warehouses to enhance their labor and stocking efficiencies as well.

Measures and Metrics of WH Operations (Contd.)

- **Stocking Efficiency** (Slotting) metrics primarily measures the efficacy of the warehouse space usage.
- These metrics show how racking and slotting needs are being fulfilled and how these decisions affect the operations by affecting picking, put-away, and replenishment task efficiencies, active and reserve locations.
- They show how efficiently are item volume, density and orientation, demand patterns, and handling patterns used in deciding the stocking locations of the items in the warehouse.
- Incidentally, the metrics that measure these (stocking) efficiencies are reflected directly in the operational metrics: a well slotted warehouse maximizes the warehouse cube and simultaneously enhances the operational efficiency by saving the overall distance traveled in the warehouse, work balancing to avoid congestion, enhanced ergonomics by making it easier to handle products through optimally stocking them by location, height, and handling characteristics, and finally the order fulfillment accuracy by considering demand patterns.

Measures and Metrics of WH Operations (Contd.)

- **Financial metrics** measure the costs of labor, operations, utilities, depreciation of capitalized assets, and fixed costs.
- They directly depend on other metrics and will improve directly in response to the improvements in the other metrics.

Warehouse Operations Assessment

- Warehouse Operations Assessment is a systematic review of the warehouse functions looking for possible improvements in efficiency and service.
- An operational assessment can help you
- improve productivity
- use distribution center space more efficiently
- improve throughput and capacity of orders processed in the warehouse
- streamline work-flow by reducing steps
- improve service levels, processes and costs
- And generally achieve higher profits and lower costs
- The assessment process enables you to identify areas where you can improve operational performance.

Warehouse Operations Assessment – Contd.

- The five basic components of the assessment are:
- Walkthrough and observations of the operation
- Data gathering of necessary information and metrics
- Interviews with key staff members
- Report analysis to determine current productivity and service levels - Among the types of reports you should consider are basic internal operations performance reports, including service levels such as order shipping accuracy, order turnaround time, etc.; receiving; quality assurance; stock put-away; returns; inventory control; replenishment; and picking, packing and shipping.
- External benchmarking to look for areas of potential improvement - Compare your results against yourself and against a set of standards or expectations over an established time period

Warehouse Operations Assessment (Contd.)

- Four Critical Areas to Assess
- There are four key areas that should be evaluated in the warehouse.
- They make up the most critical aspects of any fulfillment operation. They are:
- **Labor** is incontestably the most expensive area on your Profit and Loss (P&L) statement relating to fulfillment, so it's important to get the most for your payroll dollar.
- Labor consists of four areas - Productivity, Cost of labor, Turnover and training, Local labor market.
- **Facilities** should be examined to determine whether you have enough space and whether you are using the space you have efficiently and cost effectively.
- Components include - The cube (Focus cube utilization on storage, picking and packing), occupancy costs, seasonality (operations in peak and off-peak seasons), housekeeping/maintenance.

Warehouse Operations Assessment (Contd.)

- **Workflow and Procedures** - Your goal is to minimize the number of times a product is handled, and the number of steps your crew has to take to move the product through the facility.
- **Systems** should provide the functionality and flexibility you need, supporting efforts to maximize space and labor efficiency.
- In most warehouse operations, the three key areas of concern are slotting, replenishment and location control.
- **Final Steps: From Assessment to Action**
  Once you've gathered and analyzed all the information you can, patterns will emerge and you'll have a quantifiable picture of what you do well and what needs to be improved.
- The final step—the action plan—is what will make your assessment yield meaningful results. In creating your plan, focus on areas that will yield the greatest benefit.

Warehouse Operations Assessment (Contd.)

- Write your action plan so that it provides for continual improvements over time. It should include detailed action steps, assignment of accountability, and expected completion dates.
- Manageable changes introduced gradually will be more effective and more readily accepted by your workforce than one massive overhaul.
- Gradual change helps make continual improvement a part of your corporate culture.
- Make sure any plans you develop include clear action steps, accountabilities, and timelines.
- Comprehensive assessments should be conducted on an ongoing basis to stay in touch with customer needs, accommodate your company's growth, keep pace with your competition's improvements—and to keep up with whatever promises your marketing department is dreaming up right now.

Information Systems in a warehouse

Information Systems in a Warehouse (Cont..)

- A Warehouse Management System (WMS) is a software application that supports the day-to-day operations in a warehouse.
- WMS programs enable centralized management of tasks such as tracking inventory levels and stock locations.
- WMS systems may be standalone applications or part of an Enterprise Resource Planning (ERP) system.
- Early warehouse management systems could only provide simple storage location functionality.
- Current WMS applications can be so complex and data intensive that they require a dedicated staff to run them.
- Current WMSs are capable of being highly complex and handle significant amounts of data many companies will allocate an entire staff to the operation of the software.
- High-end systems may include tracking and routing technologies such as Radio Frequency Identification (RFID) and voice recognition.

Information Systems in a Warehouse

- The primary purpose of a WMS is to control the movement and storage of materials within an operation and process the associated transactions.
- Directed picking, directed replenishment, and directed put-away are the key to WMS.
- The basic logic of WMS will use a combination of item, location, quantity, unit of measure, and order information to determine where to stock, where to pick, and in what sequence to perform these operations.
- At a bare minimum, a WMS should:
  - Have a flexible location system
  - Utilize user-defined parameters to direct warehouse tasks and use live documents to execute these tasks
  - Have some built-in level of integration with data collection devices

Information Systems in a Warehouse (Contd.)

- **Benefits**: Despite the complexity, WMS implementations do offer businesses significant benefits.
- Not only will placement and removal cycle times be reduced, but inventory accuracy should be improved as well as increased storage capacity, more organized storage of materials and greater flexibility of warehouse operations.
- Beyond labor efficiencies, the determining factors in deciding to implement a WMS tend to be more often associated with the need to do something to service your customers that your current system does not support (or does not support well) such as FIFO, cross-docking, automated pick replenishment, wave picking, lot tracking, yard management**, automated data collection, automated material handling equipment, etc.

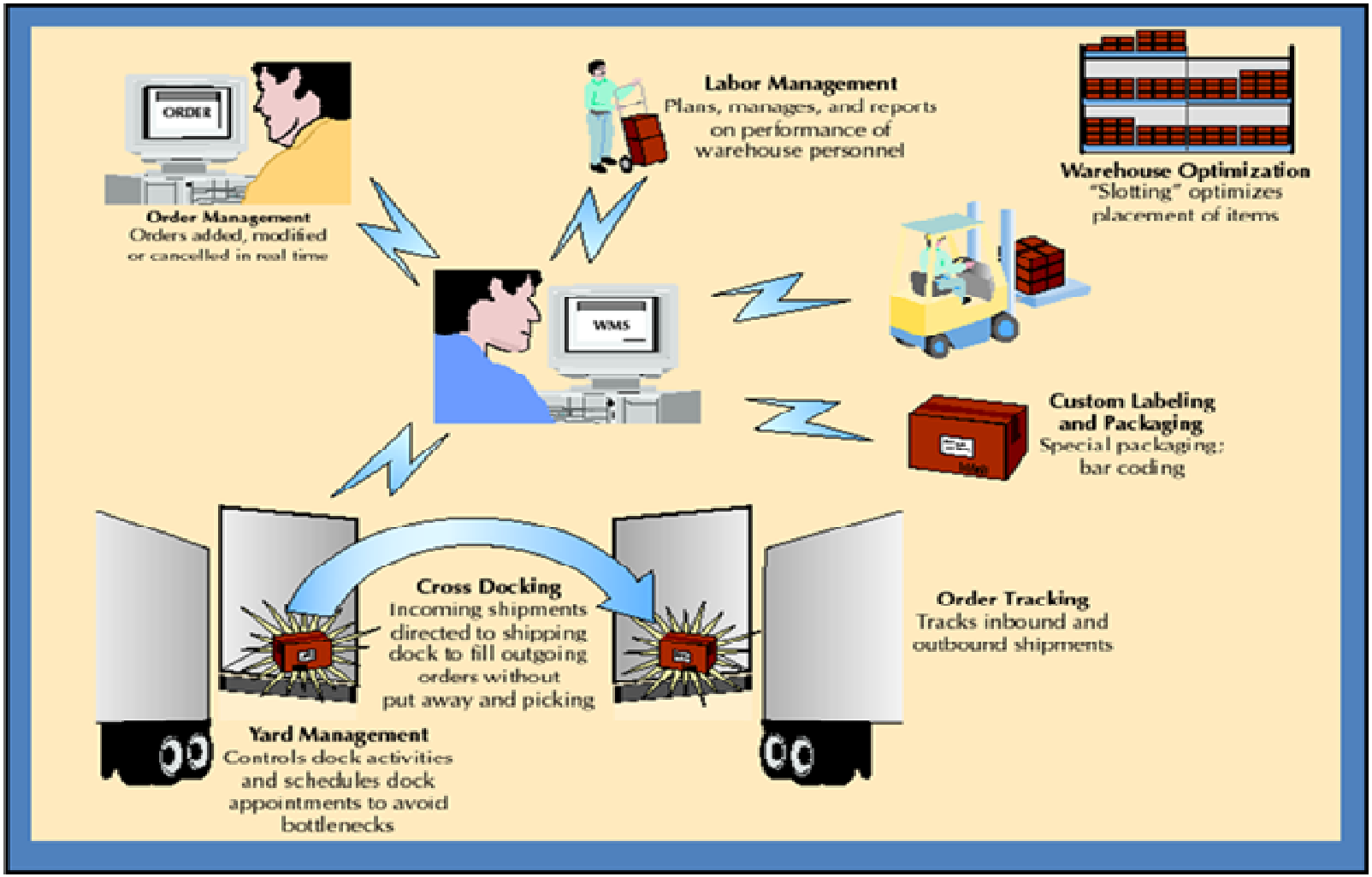
Information Systems in a Warehouse – Terms Used

- **Enterprise resource planning (ERP)** systems integrate internal and external management information across an entire organization, embracing finance/accounting, manufacturing, sales and service, customer relationship management, etc.
- ERP systems automate this activity with an integrated software application.
- Their purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders.
- ERP systems can run on a variety of computer hardware and network configurations, typically employing a database as a repository for information.

Information Systems in a Warehouse – Terms Used (Cont..)

- **Radio Frequency identification (RFID)** is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking.
- The tag contains electronically stored information which can be read from up to several meters (yards) away.
- Example: An RFID tag attached to an automobile during production can be used to track its progress through the assembly line.
- **Voice or speech recognition** is the ability of a machine or program to receive and interpret dictation, or to understand and carry out spoken commands.

Features of Warehouse Management System (WMS)



Additional References

Additional References

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Thank You