



Warehousing and Material Handling

Learning Outcomes

By the end of this unit the learner will be able to:

- ✓ Recognise the Purpose of Warehouses
- ✓ Analyze the Activities within a Warehouse
- ✓ Examine Aims of Warehousing & Material Handling.

Purpose of Warehouses

Introduction

People use different terms for warehouses, but the most general being **distribution centres** and **logistics centres**. Sometimes, they explain distribution centres as hoarding finished goods on their way to end customers, while logistics centres store a broader mix of products at diverse points in the supply chain.

A **WAREHOUSE** is any site where material is stocked on their way to supply chains. Apart from storeroom, warehouses can be used for a lot other activities.

If we talk about warehouses storing materials, this is actually merely part of the story. Many organisations are utilizing warehouses as suitable locations for doing various related jobs. Obviously, they can be used to examine, sort materials and shatter bulk (taking large deliveries and breaking them into smaller quantities). They might also be used for finishing products, , packaging, labelling, making products 'store ready' for retailers, doing other aspects of delay, and servicing seller managed inventories, etc.

Fitting into the Logistics Strategy

As always, there is a chain of command for making decisions, with the policy leading to a chain of tactical and operational decisions. Apart from the clear factor of total throughout, there are some other significant factors in choosing the most excellent size for a warehouse. These include:

- The number of products using the warehouse;
- The kind of demand for every product, how much it varies, standard order size, and so on;
- Physical qualities of the products, specifically based on size and weight;
- Special storage situations, such as climate control, and packaging, etc.;
- Target customer service level;
- Lead times from suppliers and promised to customers;
- Economies of scale;
- Kind of material handling equipment; and
- Plan of storage and associated facilities.

Warehouse operations have to function in the logistics strategy. We can describe one approach to this with the following steps:

1. **Examine the logistics policy** – setting the context and deciding what the warehouse has to attain.

2. **Examine existing operations** – to observe the failings and how these can be conquered.
3. **Design an outline structure** – finding the best major location and number of sub-depots, etc.
4. **Make thorough plans** – finding the mass of facilities, stock holdings, and material handling equipment, systems to expand, people to utilize, transport needs, and so on.
5. **Get closing approval** – submitting the plans to superior managers to concur the funding.
6. **Finalise building design** – purchasing land, choosing contractors and building.
7. **Finalise equipment design** – choosing equipment, suppliers, and purchasing.
8. **Finalise systems design** – designing the ordering, inventory control, billing, goods location, monitoring, and all other systems needed.
9. **Fit out** – installing all equipment, systems, staff, and testing,
10. **Open and obtain stock** – to test all systems, finish training, and begin operations.
11. **Sort out teething problems** – to get things running smoothly.
12. **Monitor and control** – ensuring that everything works as planned, measuring performance, and revising incentive schemes, etc.

Activities within a Warehouse

Basic Activities

We can add a number of details and get the following list of activities that are usually included in 'warehousing'.

- Receiving goods from upstream sellers;
- Identifying the goods, matching them to orders and finding their planned use;
- Unloading materials from delivery vehicles;
- Doing any essential checks on quantity, quality, and state;
- labelling materials (usually with bar codes) so they can be recognized;
- Sporting goods as essential;
- Moving goods to mass storage area;
- Holding them in stock until required;
- When required, moving materials from mass storage to a smaller picking store;
- Picking materials from this store to meet orders;

- Moving the materials to a marshalling area;
- Assembling materials into orders;
- Packing and packaging as necessary;
- loading delivery vehicles and dispatching the order; and
- controlling all communications and connected systems, such as, inventory control and finance.

Other Activities in Warehouses

Today, organizations try to shift materials fast through the supply chain, so their role has changed.

They are now taken more as staging points through which materials shift as fast as possible. As their role in long-term storage has decreased, they have turned out to be suitable locations to do a variety of other jobs. They are, for instance, the finest place for sorting materials, packing, and consolidating deliveries.

A different type of consolidation happens when a manufacturer makes, or buys, parts of a finishing product in diverse locations. Then, it can organize for all components to be sent to a warehouse which unites the parts into the final product, and organizes delivery to customers.

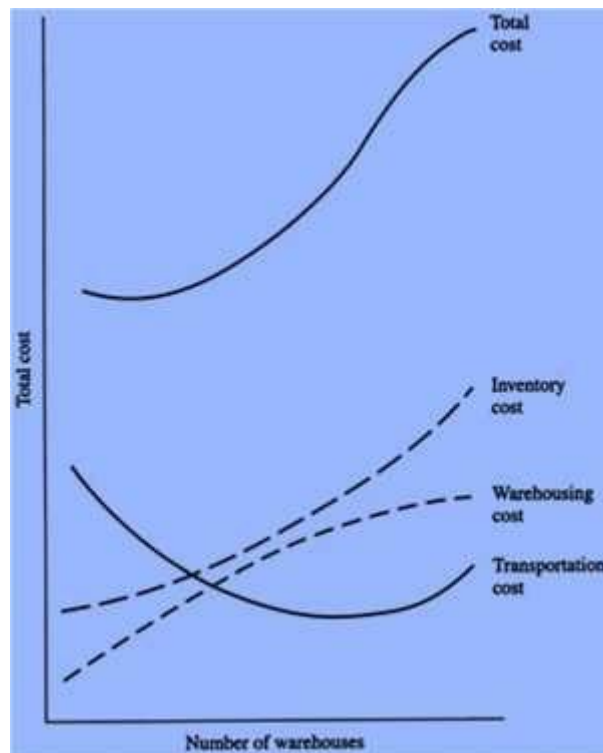


Fig 1.1 Using warehouses to reduce transport costs

This sort of consolidation can go further than just bringing together materials from diverse sources. It may add the final packing and packaging to present a single product, or even do an inadequate amount of final manufacturing. This is the root of **postponement**, where the final steps of construction are left to the last

potential moment. This has the benefit of reducing stocks and rising flexibility to meet late changes in consumer demands.

Aims of Warehousing

In general, the objectives of a warehouse are to sustain the broader logistics function by giving a mixture of high shopper service and low costs.

More exact aims include:

- Providing necessary storage at key points in a supply chain;
- Giving secure storage of the type needed by materials;
- Keeping all materials in good condition and with minimal damage;
- Giving high customer service;
- Doing all necessary activities efficiently and with low costs;
- Getting high productivity and utilisation of resources;
- Controlling all movements of materials effectively and without errors;
- Sorting materials arriving and quickly transferring them into storage;
- Picking materials departing, quickly transferring them out of storage and consolidating deliveries;
- Being able to store the whole range of materials needed;
- Being flexible enough to deal efficiently with variations in stock levels;
- Allowing for special conditions and rotation of stock, etc.; and
- Giving safe working conditions and compliance with regulations.

Ownership

A lot of organisations own and operate their own warehouses. But for small organisations, this would be both hard and costly, so they use facilities provided by focused warehousing companies. Even large companies can gain from this agreement, so they have a vital choice between **Private And Public Warehouses**.

Private warehouses are owned or leased by a business as part of its own supply chains. The business runs its own warehouses to sustain its major operations. This gives greater control over a middle part of logistics and allows incorporation of warehousing with the broader activities of logistics.

A public warehouse is run as a self-governing business, which makes money by charging users a fee. There are a lot of types of public warehouse, including bonded warehouses, cold stores, bulk storage, tankers, and various speciality stores. The facilities accessible are usually so flexible that an organisation can obtain

within reason, any facilities that it requires. There are also a lot of arrangements for their use. The main advantage of public warehouses is their flexibility. Some other benefits include:

- Flexibility to deal with changing demand, possibly due to seasonality;
- Ability to supply skills and knowledge that the business does not have internally;
- Access to the newest equipment and practices;
- Avoiding big capital investment, giving higher return on investment;
- Easy access to a wider geographical regions;
- Allowing immediate tests of working in new areas;
- Use of economies of scale to lessen warehousing costs;
- Consolidating loads with other organisations to decrease transport costs;
- Certain high quality and well-organized service; and
- Flexibility to deal with varying conditions, removing risks from dated practices and technology.

The move towards contracting out warehousing means that the most widespread arrangement for warehousing is maybe a combination of private and public. The choice between private and public warehousing is frequently seen as another feature of the 'make or buy' decision, and is often presented as a break-even analysis. Private warehouses have elevated fixed costs but lower unit operating costs, while public warehouses have small fixed costs but potentially high variable costs.

Layout

General Layout

One of the most significant decisions when operating a warehouse is its design. This describes the physical plan of storage racks, loading and unloading areas, offices, rooms, equipment, and all other facilities.

Layout decisions are imperative for three essential reasons: (1) they need substantial investments of both money and effort, (2) they involve long-standing commitments ... (3) they have important impact on the cost and competence of immediate operations.

This suggests that the necessary elements in a warehouse are an arrival bay or dock, where goods coming from suppliers are delivered, checked, and sorted -

- A storage area, where the goods are kept as stock;
- A departure bay, or dock, where customers' orders are assembled and sent out;
- A material handling scheme, for moving goods around; and
- An information system, which records the site of all goods, arrivals from suppliers, departures to consumers, and other applicable information.

There are a lot of variations on this fundamental outline. The most general one – which is also used in most supermarkets – in fact, has two storage areas. Goods arrive and are put into a mass store (the backroom in a supermarket) which is the major storage area.

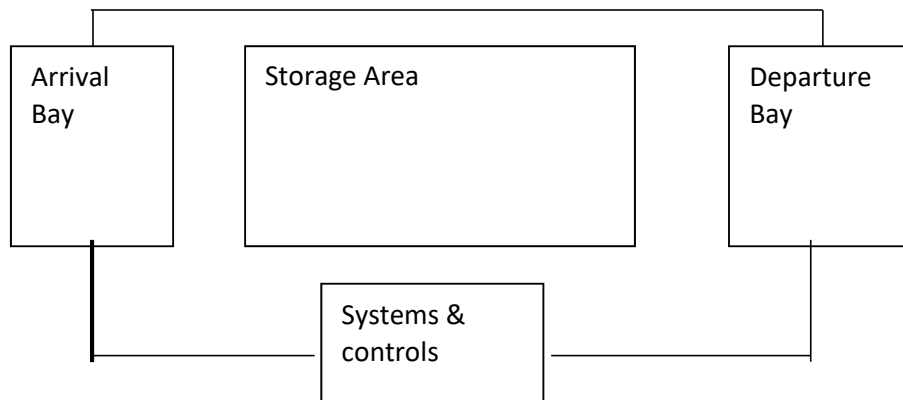


Fig: 1.2 Basic Layout of a warehouse

The packages in the mass store are wrecked into individual units and shifted to a smaller picking store that is used to collect orders (the shelves in a supermarket). When an order is received, the items required are ‘picked’ from the smaller, picking store and brought jointly in a consolidation area, before moving to the departure bays. When stocks in the picking store run low, they are refilled from the bulk store. This gives the run of materials from arrival bays, bulk store, picking store, consolidation area to departure bays.

Layout of Racking

In most of the warehouses, materials are stocked in some shape of shelving or racking.

This can get a lot of forms, leading to three fundamental questions:

- What kind of racking should be used?
- What is the most excellent layout for the racking?
- Where should diverse items be stored on the racks?

One way of planning the design is to:

- ✓ Approximate demand for materials over the subsequent five years or so;
- ✓ Translate this into estimate movements of materials into, through and out of the warehouse;
- ✓ Compare accessible equipment for treating these movements and decide the most suitable;
- ✓ Find the room required for storing and moving every item;
- ✓ Design a broad-spectrum layout for the racking;
- ✓ See which materials should be close to each other ;
- ✓ Develop outline plans for the layouts and handling areas and choose the best; and
- ✓ Add details to offer final plans.

Experience does, though, make some suggestions for superior layouts.

These include:

- Plan the layout to give a smooth flow of materials into, through and out of the warehouse;
- Simplify movements, eliminating or combining separate movements where possible;
- Use high level storage where possible, as this reduces the overall area;
- Have offices outside the main warehouse area, as space above them is wasted;
- Consider using spare roof space for overhead movement of materials;
- Give appropriate space for aisles – as narrow as possible to reduce non-working space, but wide enough for equipment
- Consider mezzanine floors for picking and administration
- Have movements in straight lines on one floor.

Locating Materials on Shelves

A lot of costs of running a warehouse are permanent – such as the rent, local taxes, utilities, and depreciation. Some of these costs are put out by the management policy, such as the total investment in stock. The major variable cost comes from the particulars of the layout, and depends on the time required to locate items and either add them to store or eliminate them. When there are thousands of items in store, little differences in the way they are placed can give markedly diverse service and costs.

Turnaround Time

Apart from the design of the storage areas, the competence of a warehouse also depends on how fast it deals with delivery vehicles. There are numerous measures of **turnaround time**, however the most general is the time taken between a vehicle arriving (either delivering materials or collecting them) and departing.

Three arrangements can assist with this. First, orders can be brought together and waiting to shift onto a vehicle – when the vehicle arrives, it is loaded rapidly and moved on. Second, special loading and unloading apparatus can be used to speed up operations.

Materials Handling

A lot of the work in a warehouse shifts materials from one place to another. Everything has to be taken from delivery vehicles, moved around the warehouse – often quite a few times – and finally put onto departing vehicles. The activities form division of **materials handling**.

MATERIALS HANDLING relates to the flow of materials for small distances usually within a warehouse, or between storage areas and transport.

Some objectives of materials handling include:

- Moving materials around a warehouse, as necessary;
- Moving materials fast, reducing the number and length of movements;
- Increasing storeroom density, by dipping the quantity of wasted space;
- Reducing costs, by using well-organized operations; and
- Making little mistakes, with competent material management systems.

Manual Warehouses

This is most likely the easiest planning to visualize, and is still one of the most frequent. Items are stored on shelves or in bins. People go around and choose items from the shelves, and put them into some kind of container for movement – like a supermarket trolley. Manual warehouses only work if the items are small and light enough to lift. Shelves must be low enough for them to achieve and close together to decrease the distance walked.

Mechanised Warehouses

Mechanised warehouses substitute some of the muscle power of manual warehouses by machines.

Typical examples of mechanised equipment are:

- Reach trucks;
- Order-picking machines;
- Forklift trucks;
- Cranes;
- Towlines;
- Conveyors;
- Tractors or trains; and
- Carousels

These warehouses can amass heavier goods and might be much bigger. Some equipment needs broad aisles to manoeuvre, but racking can be higher – usually up to 12 metres with a forklift truck and higher with cranes or high-reach equipment.

Automated Warehouses

Traditional warehouses, including mechanised ones, tend to have elevated operating costs. These operating costs can be decreased as well as recovering aspects of service, by using mechanization. Unfortunately, this requires a very high investment in apparatus, and is only actually worthwhile for extremely big stores that shift large amounts of materials.

Automated warehouses include the following components:

- Storage regions that can be accessed by mechanical equipment; these often make use of narrow aisles up to, say, 40 M. tall to get an elevated density of materials and reduce the distances moved.
- Equipment to shift materials around the warehouse; these are typically automated guided vehicles (AGVs)
- Equipment to mechanically choose materials and place them into storage, including high speed stacker cranes that can arrive at any point in the thin aisles very fast.
- Equipment to move materials between the diverse types of equipment; these mechanical loaders and unloaders may include industrial robots.
- A warehouse administration system to record material locations, and manage all movements.

Choice of Equipment

In general, high volumes of throughput make use of higher levels of mechanization. Warehouses for short volumes of throughput (like a shop) are generally manual, medium volumes of throughput (like a food warehouse) are mechanised, and high volume of throughput (like an e-mail book seller) are automatic, Although it is significant, volume is just one factor in the selection of equipment. The last decision requires a lot of examination, with the key factors likely to include:

- Physical characteristics of loads – size and weight, etc.;
- Number of loads to be moved – from the throughput of the warehouse, plus any internal movements for sorting to checking, etc.;
- Distance to be moved – from the size of the warehouse; and
- Speed of movement required – how quickly the warehouse has to respond to demands, etc.

Packaging

Standard Packages

We have previously mentioned pallets (the standard wooden trays about four feet square that materials are placed on to alleviate movement) and containers (metal boxes that are used to shift a huge range of goods around the world). Collecting together materials into these benchmark packages is called **unitisation** to shape **unit loads**. It is much easier to move standard loads than it is to shift a diversity of different sizes and shapes. If a company always uses standard loads, it can set up all its managing equipment to move these well.

Purpose of Packaging

Many items require special protecting packaging during moves, chiefly delicate things like china and electronics. Sometimes the wrapping can defend goods from harsh environments, such as rain or sun;

sometimes it is essential to part materials that would pollute each other, such as sugar and petrol; sometimes it keeps the contents clean, such as foodstuffs and medicines. In general, packaging serves four basic functions as it:

- Recognizes the product and gives fundamental information;
- Protects items while they are being shifted through the supply chain;
- Makes treatment easier; and
- Assists in promotion, promoting the product, advertising and giving information to Customers.

The balance between these greatly depends on the product.

There are also two kinds of packaging to consider.

First, the interior, or **consumer packaging**, as it is better known, is made for the consumer and includes the advertising and promotional materials. This is the one that is brilliantly coloured and has cellophane and advertisements.

Second, the exterior or **industrial packaging** that is used to defend and make handling easier. This is the simple box or pallet that gives information to businesses in the supply chain.

There are five chief materials for packaging:

- Glass is simple to clean, reuse and reprocess, but is easily broken, comparatively expensive and hard to make;
- Plastic is light, strong and simple to clean, but can be costly and hard to create or reuse;
- Cardboard is light, inexpensive, and can be recycled, but has slight strength and poor toughness;
- Wood is strong, tough, easy to use and can be reused, but it is weighty, bulky and tricky to clean; and
- Metal is strong and tough, but it is weighty and can be costly.

The choice of these – or other materials – depends mainly on the kind of products, movement and protection required.

Packaging Waste

When you purchase something, you may be surprised by the amount of packaging. Cakes and chocolates usually have three layers of packaging; sometimes you may find up to five layers. But remember that you merely see the customer wrapping, and there have almost certainly been two more layers of industrial wrapping which has already been separated.

This is a significant issue, as the European Union, and other areas are introducing restrictions on the quantity of packaging waste that businesses can discard. Several countries simply allow glass containers if

these are composed and reused, or at least recycled. There are alike regulations for metal containers, chiefly aluminium cans. Maybe more obvious are the regulations on other packaging, which are ever more forcing business to record the amount of packaging they employ and the amount they reprocess. If they fail to attain some target for recycling, they face serious fines. The European Union has moved towards this plan, with in general recycling targets of 50%.

Further Reading:

- ✓ Edward Frazelle, (2002), World-Class Warehousing and Material Handling
- ✓ Myer Kutz, (2009), Environmentally Conscious Materials Handling
- ✓ Riccardo Manzini, (2012), Warehousing in the Global Supply Chain
- ✓ Gwynne Richards, (2011), Warehouse Management : a complete guide to improving efficiency and minimizing costs in the modern warehouse