

STORAGE WAREHOUSE AND MATERIAL HANDLING

*Project report submitted for partial fulfilment of the requirement for the
degree of
Master Of Business Administration*

**(INTERNATIONAL TRANSPORTATION AND LOGISTICS
MANAGEMENT)**

By

**AMIT MILIND UBALE
Registration No.: 2105305036**

*Under the Supervision of
Dr. ARAVIND T.S
Assistant Professor*



**SCHOOL OF MARITIME MANAGEMENT
INDIAN MARITIME UNIVERISTY
Kochi CAMPUS
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INDIAN MARITIME UNIVERSITY



INDIAN MARITIME UNIVERSITY

(A Central University under Ministry of Port, Shipping and Waterways)

SCHOOL OF MARITIME MANAGEMENT

Dr. Aravind T.S

Faculty of maritime management

School of maritime management

Indian Maritime University,
Kochi Campus

Kochi

Date: 18/03/2023

CERTIFICATE

This is to certify that the Project titled "STORAGE WAREHOUSE AND MATERIAL HANDLING" submitted by AMIT MILIND UBALÉ register number 2105305036 of MBA ITLM is a bonafide record of his project report and submitted to the School of Maritime Management, Indian Maritime University, Kochi campus, under the supervision of Dr. Aravind T.S, faculty IMU Kochi Campus. It is also certifying that the above work has not previously formed or submitted for the award of any degree, diploma associateship also fellow ship or other, similar titles, and it is an independent work done by the candidate.

Dr. Aravind T.S
(Project Guide)

DECLARATION

The project titled "STORAGE WAREHOUSE AND MATERIAL HANDLING" has been carried out under the direction of Dr. ARAVIND T.S in partial fulfilment of the requirements for the award of the degree of Master of Business Administration in International Transportation and Logistics Management to be submitted to the School of Maritime Management, Indian Maritime University, Kochi Campus.

PLACE: *Kochi*

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Amit

AMIT MILIND UBALE

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EXECUTIVE SUMMARY

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Storage warehousing and material handling are crucial aspects of supply chain management that ensure the efficient movement and storage of goods. The following is an executive summary of these concepts:

1. **Storage Warehousing:** It refers to the process of storing goods in a facility until they are needed for use. Warehouses are often used to store inventory for retailers and wholesalers. They also serve as a hub for receiving, storing, and dispatching goods. Effective warehouse management involves optimizing space utilization, managing inventory levels, and ensuring timely delivery of goods.
2. **Material Handling:** It refers to the movement, control, and protection of goods throughout the supply chain. Material handling equipment such as forklifts, conveyor systems, and cranes are used to move goods from one location to another. Effective material handling involves selecting the right equipment, designing efficient material flow processes, and ensuring the safety of workers.
3. **Integration of Storage Warehousing and Material Handling:** Effective integration of these two concepts can improve the efficiency and productivity of the supply chain. This can be achieved by automating material handling processes, implementing advanced inventory management systems, and utilizing data analytics to optimize warehouse operations.

Overall, storage warehousing and material handling are critical components of the supply chain that play a significant role in ensuring the timely delivery of goods to customers while minimizing costs and maximizing efficiency.

ABBREVIATIONS

PL: Third party logistics

ADC: Automated data collection

APS: Advanced planning and scheduling

ASN: Advanced shipment notifications are used to notify a customer of a shipment. Often including purchase order numbers, SKU numbers, lot numbers, quantity, pallet or container number, carton number

ASRS: Automated Storage Revival system

ASP: Application service provider

AIDC: Automatic identification & data collection

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BOM: Bill of material is a list materials required to produce an item

CCD: Charged coupled device is a barcode scanner that takes digital image of the barcode instead of laser scanning, can only scan at short distance of a couple of inches

COGS: Cost of Goods Sold

CPG: Consumer Packaged Goods

DC: Distribution Centre

EPC: Electronic product code is the RFID version of the UPC barcode. EPC is intended to be used for specific product identification

FMCG: Fast Moving Consumer Goods

FIFO: First in first out

GVW – Gross Vehicle Weight

LIFO: Last-in-first-out

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INTRODUCTION

1. The purpose of storage warehouse and material handling is to provide a secure, organized and efficient way to store, handle and move products, materials and equipment. The storage warehouse is used to keep products and materials secure and protected from environmental hazards like theft, weather and pests. Material handling involves the movement, transportation and storage of products throughout the supply chain. Effective material handling reduces the time and cost required to move products from one location to another, increases productivity and minimizes damage during transportation. Both storage warehouses and material handling play a crucial role in ensuring the smooth operation of the supply chain and minimizing Waste and inefficiencies In a warehouse environment, material handling is commonly defined as the “movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal.” The process incorporates a variety of manual, semi-automated and automated equipment and systems . Warehousing is the act of storing goods that will be sold or distributed later. While a small, home-based business might be warehousing products in a spare room, basement, or garage, larger businesses typically own or rent space in a building that is specifically designed for storage.

Warehousing and all that goes along with it is part of a sophisticated industry known as logistics management. Logistics includes procurement, inventory management, and distribution. It falls under the supply chain umbrella, which also includes product development, marketing, sales, and other product-related disciplines Whether the purpose is strictly storage or storage plus order fulfillment, warehouses use specific elements that help manufacturers, distributors, and retailers monitor inventory and store it safely. An overview of basic elements includes :Shelving and rack systems that offer maximum storage capacity and easy product acces. A climate control system for the product being stored. This is particularly important for frozen products or those requiring refrigeration, including certain pharmaceutical or laboratory products, and others that degrade if exposed to too much heat .Inventory control software that tells the product owner – who isn’t necessarily the building owner – where all individual units are in the system at all times. Equipment that can move products from point A to point B – forklifts, pallet jacks, bins that hold products for orders, and conveyor belts

Security to protect stored products.

Access to cost-effective transportation to bring products in or move them out as orders are fulfilled. That often means easy access to interstates, rail lines, or airports.

A warehouse is a commercial building for storage of goods. Warehouses are used by manufacturers, importers, exporters, wholesalers, transport businesses, customs, etc. They are usually large plain buildings in industrial areas of cities, towns and villages.

They 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. 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 and production. In India, a warehouse may be referred to as a godown. Material handling involves short-distance movement within the confines of a building or between a building and a transportation vehicle. It uses a wide range of manual, semi-automated, and automated equipment and includes consideration of the protection, storage, and control of materials throughout their manufacturing, warehousing, distribution, consumption, and disposal. Material handling can be used to create time and place utility through the handling, storage, and control of material, as distinct from manufacturing, which creates form utility by changing the shape, form, and makeup of material. Packaging is the science, art and technology of enclosing or protecting products for distribution, storage, sale, and use. Packaging also refers to the process of designing, evaluating, and producing packages. Packaging can be described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use. Packaging contains, protects, preserves, transports, informs, and sells. In many countries it is fully integrated into government, business, institutional, industrial, and personal use.

2. RESPONSIBILITIES OF STORAGE WAREHOUSE AND MATERIAL HANDLING

2.1 Station Head The station head is responsible for ensuring that a competent authorised person is appointed to control the inventory of lifting equipment and arrangements

Its periodic examination in accordance with relevant standards and procedures All supervisors involved in materials handling understand the requirements of this Standard. A system of review and control is established to ensure that the implementation of this standard is assessed on a regular basis as appropriate to the requirements of the operation.

2.2 Competent Authorised Person (CAP)

The Competent Authorised Person (CAP) is competent by virtue of training, experience and

qualification and is appointed to examine lifting equipment on behalf of the Station Head. He

is not only competent to inspect for damage, deterioration or other defects, but is also capable of assessing and advising what effect such defects will have on the strength and function of the lifting equipment. CAP qualifications must be assessed and verified.

The CAP must supervise the examination and maintenance of all loose lifting equipment within his area of responsibility every six months and must ensure timely inspection and test

of other items of lifting equipment requiring inspection and testing by third party.

The CAP must maintain a register and keep a copy of certificates for each piece of lifting equipment under his control.

- Date received
- Serial number
- Description
- Safe working load

Material Handling and Storage Procedure

Storage management: The primary function of a storage warehouse is to store goods and materials in a safe and secure manner. The warehouse manager is responsible for ensuring that the storage area is clean, organized and well-maintained, and that the goods are stored in the appropriate conditions to prevent damage or deterioration.

Inventory management: The warehouse manager is also responsible for maintaining accurate inventory records of all the goods stored in the warehouse. This includes tracking the inbound and outbound shipments, monitoring stock levels, and ensuring that the warehouse is adequately stocked with the necessary items.

Material handling: Material handling encompasses all the activities involved in the movement, storage, and retrieval of materials within the warehouse. This includes loading and unloading trucks, transporting goods to and from storage areas, and handling materials within the warehouse.

Quality control: The warehouse manager is responsible for ensuring that the goods stored in the warehouse meet the required quality standards. This includes inspecting incoming shipments for damage or defects and conducting regular quality checks to ensure that the stored goods are still in good condition.

supply chain industry and companies taking a proactive approach on this matter will be able to set themselves apart from competitors.

I think this point speaks for itself. If you cannot deliver what the customer needs in a timely manner, there will be a competitor out there that can. We are living in a “now-culture” which has engulfed the logistics industry, as industry giants such as Amazon promise 30-minute home deliveries. I am not saying this is something that every wholesaler must be able to do, but I do believe that in our “now culture” where impatience is a growing factor, the ability to make punctual deliveries will be a leading factor that will separate excellent supply chains from ordinary supply chains.

1.4. CHARASTERICS OF STORAGE WAREHOUSE AND MATERIAL HANDLING

1. Storage Warehouse Characteristics:

- Adequate storage space for products
- Multiple storage options (e.g. shelves, racks, bins, pallets)
- Proper lighting and temperature control
- Security measures (eg.locks, alarms, cameras)
- Organization and labeling for efficient product retrieval
- Accessibility for loading and unloading products
- Regular maintenance and cleaning to ensure safety and cleanliness

2. Material Handling Characteristics:

- Equipment for moving and transporting products (e.g. forklifts, conveyor belts)
- Proper training and certification for employees operating equipment
- Safety protocols to prevent accidents and injuries
- Efficient system for tracking and managing inventory
- Flexibility to adapt to different types of products and packaging
- Collaboration with other departments to ensure efficient movement of products within the warehouse
- Regular maintenance and repair of equipment to ensure optimal performance.

CHAPTER 1
INVENTORY MANAGMENT

INTRODUCTION

The efficient administration of a company's supply chain depends heavily on inventory management, forecasting, and demand planning. In order to ensure that a firm has enough inventory to meet consumer demand while limiting surplus stock that can result in higher expenses, inventory management entails controlling and optimising the amount of inventory it maintains. Forecasting and demand planning entail estimating consumer product demand, which enables businesses to plan and allocate resources to satisfy that need more effectively.

Companies can cut expenses related with excess inventory, stockouts, and ineffective production planning by using effective inventory management, forecasting, and demand planning. Businesses can reduce the risk of stockouts and overstocking by optimising their production and procurement processes to ensure that they have the proper quantity of inventory on hand. This may result in greater effectiveness, better client happiness, and more revenue.

In order to forecast future product demand, forecasting and demand planning make use of historical data, market trends, and other elements. By using this data to inform production planning, purchasing, and inventory management decisions, businesses can streamline their processes and cut costs. The accuracy of forecasting and demand planning is being increased with advanced data analysis techniques like machine learning and artificial intelligence, which benefits businesses.

In order to satisfy customer demand efficiently and effectively, while minimising costs and maximising profitability, a company's supply chain strategy must include good inventory management, forecasting, and demand planning.

Making informed company decisions about everything from inventory planning to executing flash discounts requires the process of demand forecasting, which involves anticipating future sales using historical sales data.

Inventory management follows the flow of goods to, through and out of the warehouse. The supply chain includes demand planning, procurement, production, quality, fulfilment, warehousing and customer service—all of which require inventory visibility.

1.1 Role of Inventory in Warehouse

- **Meeting customer demand:** Inventory helps to ensure that there is always sufficient stock to meet customer demand, reducing the risk of stockouts and lost sales.
- **Meeting customer demand:** Inventory helps to ensure that there is always sufficient stock to meet customer demand, reducing the risk of stockouts and lost sales.
- **Balancing supply and demand:** Inventory can help balance supply and demand by providing a buffer between production and sales, allowing businesses to match supply with demand more effectively.
- **Reducing lead times:** Holding inventory in strategic locations can help reduce lead times by ensuring that products are readily available when and where they are needed.
- **Supporting production processes:** Raw materials and work-in-progress inventory can support production processes by ensuring that materials are available when needed, reducing downtime and delays.
- **Enhancing efficiency:** Efficient inventory management, including inventory optimization, can help reduce excess inventory, minimize waste, and improve overall supply chain efficiency.

3.2 INVENTORY VALUATION

Companies use inventory valuation as a method of accounting to determine the worth of unsold inventory stock when generating their financial accounts. An organization's inventory stock is an asset, and in order to be included in the balance sheet, it must have a monetary worth. You can use this statistic to calculate your inventory turnover ratio, which will enable you to better plan your purchase actions.

➤ IMPORTANCES OF INVENTORY VALUATION

Inventory valuation involves many steps in addition to identifying the unsold items. To get a final value, you also need a rate that you may multiply by the amount. You might have paid various rates for these things during the year therefore, you need to decide on a method to determine a standard cost.

ITEM(SNEAKER)	PURCHASE(NO.)	RATE (EACH PAIR)(RS.)
JANUARY	100	2465
MARCH	150	2630
JULY	100	2630
OCTOBER	110	2630
DECEMBER	90	2876
ITEM PURCHASED	550	
ITEM SOLD	500	
ITEM UNSOLD	50	
INVENTORY VALUE	50*? (2465 or 2630 or 2876)	

You have 50 pairs of unsold items at the end of the year, but you are not sure which rate to use because of changes in the product's price. As a result, you must select a method. We will examine various inventory valuation methods in the section that follows, along with some advice that can assist you in selecting the method that is best for your company.

1.2 DIFFERENT METHODS OF INVENTORY VALUATION

There are three methods for inventory valuation: FIFO (First In, First Out), LIFO (Last In, First Out), and WAC (Weighted Average Cost).

FIFO: -You figure the first things bought are the first things to depart the warehouse. In other words, under FIFO, the items will be deducted from the first list of goods that entered your warehouse or store whenever you make a sale.

LIFO: -You assume the exact opposite: that the first things to depart your shop are those that entered last.

WAC: - Approach makes use of the item's annual average cost. By dividing the total cost by the total number of units bought during the year, the average cost per unit is determined.

At first, the idea of inventory valuation could appear a little complicated. Nevertheless, it becomes much simpler after we dissect it and show each strategy

1.3 ECONOMICS IN ORDERING

Economics is incredibly important in the context of business when ordering. Ordering is the process of obtaining products or services from suppliers in order to satisfy client demand. Maintaining an adequate quantity of inventory to meet customer demand while reducing the expense of retaining inventory is the major objective of ordering.

Economics comes into play in ordering decisions in several ways, including:

- **Economic Order Quantity (EOQ):** EOQ is a formula used to determine the optimal quantity of goods to order that minimizes the total cost of ordering and holding inventory. It considers factors such as the cost of ordering, the cost of holding inventory, and the rate of demand.
- **Just-in-Time (JIT) Inventory Management:** JIT is a system that aims to minimize inventory holding costs by ordering goods or materials only when they are needed. This system requires close coordination between suppliers and the business to ensure that goods are delivered in a timely and efficient manner.
- **Price Optimization:** Economics can also inform ordering decisions by providing insight into pricing strategies. For example, businesses may order in larger quantities to take advantage of volume discounts, or they may adjust their ordering frequency based on changes in the cost of goods.

- **Supply Chain Management:** Finally, economics plays a critical role in managing the entire supply chain, from sourcing raw materials to delivering finished products to customers. By understanding the economics of the supply chain, businesses can make informed decisions about where to source materials, how to optimize transportation costs, and how to minimize waste and inefficiency.

1.4 BASIC INVENTORY POLICIES

Basic inventory policies are the guidelines and procedures that a business puts in place to manage its inventory effectively. The goal of these policies is to ensure that the business has the right amount of inventory to meet customer demand while minimizing costs and waste. Here are some of the basic inventory policies that businesses typically follow:

- ❖ **Reorder Point:** A reorder point is the minimum level of inventory that triggers a new order. This policy ensures that the business always has enough inventory to meet demand without overstocking.
- ❖ **Safety Stock:** Safety stock is additional inventory that a business keeps on hand to ensure that it can meet unexpected demand or supply chain disruptions. This policy helps to minimize the risk of stockouts.
- ❖ **Lead Time:** Lead time is the time it takes for a supplier to deliver an order after it has been placed. This policy considers the time it takes to receive and process orders, as well as the time it takes for the supplier to deliver the goods.
- ❖ **Economic Order Quantity (EOQ):** EOQ is a formula that helps businesses determine the optimal order quantity to minimize the total cost of ordering and holding inventory. This policy considers factors such as the cost of ordering, the cost of holding inventory, and the rate of demand.
- ❖ **First-In, First-Out (FIFO):** FIFO is a method of inventory management that ensures that the oldest inventory is sold first. This policy helps to minimize waste and spoilage.

- ❖ **Inventory Turnover:** Inventory turnover is the number of times that a business sells and replaces its inventory over a given period. This policy helps to ensure that the business is not holding onto inventory for too long, which can lead to waste and obsolescence.

1.5 The single period inventory model

The single period inventory model is a model used in inventory management that is applicable when a business has a single opportunity to order a fixed quantity of inventory, and that inventory has a limited shelf life or will become obsolete after a single selling season. This model is commonly used in industries such as fashion, perishable goods, and seasonal products.

The goal of the single period inventory model is to determine the optimal order quantity that maximizes the expected profit or minimizes the expected loss. The model takes into account the following variables:

Demand: The demand for the product is uncertain and can be modelled using a probability distribution.

Unit Selling Price: The price at which the product will be sold to customers.

Unit Purchase Cost: The cost of acquiring the product from the supplier.

Salvage Value: The amount of money that can be obtained by selling any unsold inventory after the selling season.

Holding Cost: The cost of holding inventory, which includes storage, handling, and insurance costs.

To determine the optimal order quantity, the business must balance the cost of holding inventory against the potential profit or loss from selling the inventory. The optimal order quantity can be calculated using the following formula:

$$Q = (S - D) / (S - H)$$

Where:

Q = Optimal order quantity

S = Unit selling price

D = Unit purchase cost

H = Holding cost

If the expected profit from the optimal order quantity is positive, then the business should order that quantity. If the expected profit is negative, the business should not order any inventory.

Businesses who only have one chance to order inventory that will be sold during a short selling season can benefit from the single period inventory model. Businesses can choose the ideal order amount that maximises their expected profit or minimises their expected loss by weighing the cost of retaining inventory against the possible profit or loss from selling the inventory.

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CHAPTER 2
FORKLIFT TRUCKS

2 INTRODUCTION

A Forklift truck is one of the most used machines employed for several types of tasks. They range from warehouse use to large scale industry with multiple locations. They make lifting of heavy objects fast and a whole lot easier than manual lifting. There is a wide range of forklifts to select from going well with your particular requirements and necessities. Rough Terrain forklift trucks are used primarily in new construction work locations and areas where you may be on dirt or loose gravel.

Forklift trucks are either powered by propane, electricity, gasoline or diesel. Electric forklift trucks rely on the batteries to operate. Propane or gasoline forklifts are faster or stronger than electric forklifts, but they're more difficult in maintenance, & fuel can be costly. The electric forklift trucks are great for the warehouse use as they don't give-off noxious fumes like the gas-powered machines do. Forklifts are often used in the warehouses; however, some of them are meant to be used outdoors. Vast majority of rough-terrain forklift trucks operate on propane or gasoline, but some of them are powered by natural gas or diesel. Rough terrain forklifts have the greatest lifting capacity of the entire forklifts & heavy duty tires, making it likely to drive on uneven surfaces outdoors. Forklifts have revolutionized the warehouse work. Well-maintained & safely operated forklift trucks make lifting & transporting cargo infinitely easier.

It's important for the forklift operators to follow every given safety precaution while using them. Drivers must be very careful not to exceed the weight capacity or forklift. Driving a forklift truck is similar to driving a car in reverse. It means that the motorist must steer constantly to keep it moving in straight line. Always perform a scheduled forklift service on all you lifts and they will last a long time and save you countless hours of manual lifting.

Forklift Truck Types

Articulated Forklift

Articulated forklift trucks, also known as swing mast forklift trucks, are able to load and unload materials in narrow aisles. The fork platform of an articulating forklift truck can be turned right or left without having to move the truck. This allows the truck to face in a straight line as the forks are turned or twisted to access the load. They are ideal for small spaces, small trucks, and cold storage units.

Counterbalance Forklift

Counterbalance forklifts are one of the most common forms of forklifts and come in three and four wheel models. The forks of a counterbalance forklift truck stick out from the front of the truck with legs or arms for stabilization. The name of a counterbalance forklift truck comes from the counterweight at the rear of the truck behind the motor. It is positioned such that it compensates for heavy loads.

Side Loader Forklift

Side loader forklift trucks lift loads from the side and are a narrow aisle form of forklift truck. While the truck for a side loader forklift truck runs in a straight line, its forks hang off to the side. This design makes them ideal for narrow aisles where other forklift trucks cannot man ever. Side loader forklift truck forks are mounted perpendicular to the body and the direction of the truck's movement and can rotate 90o with a load.

There are two possible operating positions for a side loader forklift truck, which are a man up or man down. In the man up model, the operator is close to the load. With the man down version, the operator manipulates the forklift truck while standing on the ground. This particular design is one of the many features of side load forklift trucks, which makes them a very flexible and adaptable piece of equipment.

Straight Mast – As with telehandler forklift trucks, straight mast forklifts are designed for loading and unloading of exceptionally heavy items. They are easily maneuverable and accessible due to their heavy-duty pneumatic tires, which are larger than other rough terrain forklift trucks. Straight mast forklift trucks come in three and four wheel versions and are powered by propane or diesel fuel Order Picker Trucks

Order picker trucks function like a forklift and are controlled from a carriage on the truck where the operator is able to maneuver and position it. They have fixed forks or a working platform that is used to load products during the picking process. The forks on an order picker truck are set in a fixed static position and raised and lower with the operator. They make it possible to carry a pallet for loading or picking up items. The platform can raise the operator to pick items from warehouse racks and can reach heights of near 40 feet or higher. Walkie Forklifts

A walkie forklift is a walk-behind forklift that has a mast for lifting pallets. It has a similar function as a counterbalanced forklift and operates well in narrow aisles and tight spaces. They are commonly used to move and position pallets much like a pallet jack and are a perfect alternative for larger forklifts and small warehouse operations.

Power for a walkie forklift can be manual or powered. For the manual version, the forklift has a peddle or handle that is pumped to raise the forklift's forks. When the load needs to be lowered, a button is pushed to release the pressure. The powered version has buttons for raising and lowering the load as well as moving the forklift.

CHAPTER 3
WAREHOUSE PROCESS

e-commerce warehouses

According to a recent report retail e-commerce sales has crossed US\$ 3578 billion. The sales include product and services ordered over internet but exclude travel and event tickets.

With regard to warehousing, pure internet traders have had an advantage in developing purpose built facilities where as existing retailers and manufacturers who are selling on line need to adapt existing logistics systems and facilities to meet these new demands or create new ones to accommodate the move to multichannel retailing e-commerce warehouses

According to a recent report retail e-commerce sales has crossed US\$ 3578 billion. The sales include product and services ordered over internet but exclude travel and event tickets.

With regard to warehousing, pure internet traders have had an advantage in developing purpose built facilities where as existing retailers and manufacturers who are selling on line need to adapt existing logistics systems and facilities to meet these new demands or create new ones to accommodate the move to multichannel retailing. Secondly, the wide range of products stored requires warehouse managers to efficiently process low value, single item orders. This one of the main challenges facing all warehouses today but in particular those dealing with internet orders. Picking and packing low cost items utilize the same amount of labour and equipment as for high cost items but the margin is going to be

significantly different. Thirdly, as consumers put their muscles in the market, accuracy and on-time delivery become more important, if companies are to retain the loyalty of their customers. Inventory management is another challenge for the warehouse managers. The increase in the number of products lines will put pressure on the number of pick locations while slow moving and obsolete lines can take up much needed

space in the warehouse □ From a picking point of view the increase of product lines will result in warehouse managers having to look alternatives to improve picking

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Next day delivery is seen as the norm, which puts further pressure on the warehouse manager to balance speed with accuracy. In addition to this is the requirement to be able to

integrate systems with couriers and customer services to be able to track and trace the future

of each order. Companies such as Amazon have developed unique systems that are capable of handling

extremely large volumes of different types of products ranging from relatively small to large

goods. □The main activities of warehouses are Receiving goods in or handling is a crucial process within the warehouse. Ensuring that the correct product has been received in the right quantity and

in the right condition at the right time is one of the main function of the warehouse operation However once goods have arrived at the warehousing it is usually too late to

rectify most receiving issues., There are many steps that need to be taken before the actual act of receiving takes place and they are First, is to ensure that the supplier presents the products to the warehouse in the most appropriate way. It is normally the buyer who specifies the product and therefore may no have knowledge of the formalities for

receiving the goods at the warehouse. □ It is better that the warehouse manager also get involved in specifying and agreeing the packaging, items per carton, cartons per pallets, and any specific labelling required. together with size of the pallet and the mode of transport to ensure that the products ordered are compatible with the storage facility

It is seen many times that items arriving a warehouses in unsuitable packaging that overhangs pallets, has incorrect or badly positioned labels and with goods packed in quantities that do not relate to selling pack

quantities Areas that need to be discussed both intern all and prior to the order being placed should

include 1) Size and type of cartons □2) Type of transit packaging-cardboard, plastic

bins, metal boxes, roll cages, pallets 3) Palletized, slip sheeted or non palletize delivery of product

4) Size, length, width, height and type of pallet 5) Specific labelling, such as product description, barcode and quantitative 6) Position of label on carton and pallets. 7) Carton quantities

8) Mode of transport , delivery quantity and frequency of delivery In-handling One of the main challenges for a warehouse

manager is to match labour hours with work content. Handling a product at the least amount possible leads to reduced labour hours and as a consequence, reduced cost. Depending on the operation, labour can be the single biggest cost within a warehouse. It can be between 48 and 60 per cent of the total warehouse cost depending on the amount of automation utilized . It is also the most difficult

cost to control. Preparation Prior to the actual receipt , a number of processes need to take place. The first step is to ensure that suppliers deliver into the warehouse when you decide , not when it suits them. There will be exceptions to this for example, it is difficult to parcel/ couriers companies to adhere to booking times and deliver times due the nature of work they are performing. By providing delivery times for each supplier on their subcontract , the warehouse operations will be in control and able to match the work

hours to work content. Initially it is required to decide when are you going to receive products into the warehouse. Are you going to have deliveries throughout the day or limit them to morning shift etc. You need to match the length of the time slots to the time estimated to fulfil the task. Standard time slots do not work, as each delivery is likely to be

different. You need to keep records of the time it takes for each type of delivery and share this information

with your booking - in team. This will give the amount of labour and equipment required to

undertake the task, thus making planning a great deal easier.

By introducing a dock scheduling system are able to allocate accurate time slots, measure productivity , organize labour and also check demurrage and penalty charges. Warehouse staff need to be aware of the

product been delivered , the type of vehicle and the equipment required to offload. Once this has been ascertained and the time calculated , a suitable booking is allocated and a booking reference given to the supplier Pre-advice of the products been delivered is also advisable so that the details can be entered into the warehouse management system(WMS). This is normally in the form on an advanced shipping notification (ASN) Yard management The arrival and departure of a significant number of vehicles each day requires the use of a yard management system to ensure that there is sufficient space to park the vehicle and each vehicle is allotted to the correct dock door. Vehicles with goods for specific areas within the warehouse need to be allocated to those dock doors closest to that area. The same is true for vehicles going out from the warehouse with load. Off loading On arrival , the vehicle details need to be checked against the booking reference , the delivery notes checked against the ASN and the vehicle allotted a unloading bay or location in the yard. Vehicle seals need to be checked against the documents to ensure the load has not been tampered with on route. Prior to offloading temperature controlled vehicles , the temperature history of the vehicle whilst in transit needs to be checked , together with the current temperature of the goods Once the vehicle has positioned onto to the appropriate bay for offloading , the in-handling team should have appropriate labour and equipment to efficiently manage the offloading processes. A photograph of the load can be taken prior to offloading just in case there are any dispute regarding the load at a later stage. The most common method of unloading palletized vehicles is with a powered pallet truck, hand pallet truck or pallet jack. Some companies utilize counterbalance forklift.

3.1 DIFFERENT TYPES OF E-COMMERCE WAREHOUSING

Like any other asset of an organization, warehousing can be owned, rented, or shared. Apart from ownership, warehouses are also classified based on their capabilities. Depending upon the warehouse's cost, usage, functionalities or facilities and the value an

organization intends to derive from eCommerce warehousing, it can choose any of the following warehousing types:

Public Warehouses: -

Public warehouses are a form of warehousing and storage places that are owned by the government but are managed by private entities. They are very affordable and accessible for early-stage eCommerce organizations to store their inventory. They are typically charged for storage and transactions.

Government Warehouses

Government warehouses are a form of eCommerce warehousing that is owned and managed by the government directly. Common examples of government warehouses are shipping ports and railway courier stations found in harbours and railway stations across India. They are highly affordable, but if the business is unable to pay on time, the government has the right to seize the warehouse and get its dues by selling the inventory of the company.

Private Warehouses

Large organizations or retailers where eCommerce warehousing requirements are critical, tend to own private warehouses. They are a costlier option as the organization will start incurring warehousing acquisition costs (owning or renting), administration costs such as payments for staff, and securities and running costs such as infrastructure management like water, electricity, etc. eCommerce warehousing owned by giants like Amazon, Flipkart, etc., are examples of private warehouses.

Cooperative Warehouses

eCommerce warehousing where different businesses come together and use a shared warehouse space is called cooperative warehouses. Companies jointly own this space, and each pays a share of the rent based on their utilized area. Such businesses can either be from the same industry such as an entire village's farmers owning a warehouse during harvest season or from different industries such as a large-scale construction project with multiple partners. Each one stores its inventory in the warehouse. Even businesses outside the joint ownership contract can place their goods in the warehouse but are usually charged a higher price.

Bonded Warehouses

Bonded warehouses are a form of eCommerce warehousing that is typically used in cross-border trading. Importers can safely store their goods in bonded warehouses provided by the authorities either for shorter or longer durations before the items are cleared by customs. Importers also use these warehouses to store things until they find a buyer and then start the customs clearance paperwork.

Smart Warehouses

This are a form of eCommerce warehousing that is based on the functionalities present in the warehouse. These warehouses are called “smart” because they are usually integrated with cutting-edge technology like Artificial Intelligence, Machine Learning, robotics, etc. This helps the team track and manage inventory in a more efficient way.

Fulfilment centers are sometimes also called Distribution Centers. Unlike traditional warehouses, the inventory is usually not stored in fulfillment centers for more than a day. They are used in the downstream supply chain (towards end consumers), where these centers can break up multiple shipments and then pick and pack logistics as per specific customer orders.

Consolidated Warehouses

Another technique of eCommerce warehousing that traditional firms follow, is leasing a consolidated warehouse, either for bulking together source orders to be delivered to different customers or for bulking together customer orders from various sources. In the first case, it acts as a collection center, and in the second case, it essentially serves as a fulfillment center. Still, the inventory might be stored in consolidated warehouses for more than a day.

While the first five types differentiate eCommerce warehousing based on ownership, the last three types of warehousing describe their capabilities and functionalities. Apart from the eight common types, some warehouses have cold storage capabilities, and they are found among businesses dealing with fresh produce, meat, and the processed food industry.

3.2 BENEFITS OF E- COMMERCE WAREHOUSING

eCommerce Warehousing has unique capabilities that enable the best service to eCommerce companies. This is mainly due to the differing priorities between traditional and eCommerce companies. Some obvious benefits include:

Single Item Picking

Traditional companies' warehouses are typically planned to cater to bulk orders. Bulk orders could either be a single large appliance or multiple smaller items.

For example, in a retail supermarket chain, the warehouses are used to process large replenishments of orders for the actual supermarket. They usually tend to be a whole truckload of items to serve different outlets across the region. The end customer buys the final item, which is either a single product or an entire cart of groceries.

In the case of eCommerce warehousing, we skip the retail outlet part and enable the customer to order directly from the warehouse. Customers can order an item as small as a box that can be shipped from across the nation.

Faster Delivery

One of the biggest advantages for eCommerce companies has been the speed of delivery promised to customers. Thanks to eCommerce warehousing companies, same-day delivery has now become a norm. We have also seen companies slowly trying to capture the instantaneous delivery market where promised delivery times are as low as 10 minutes.

All of these have been made possible by eCommerce warehousing, which looks at factors right from the network design of fulfillment centers to the way operations are planned within the dark store models for faster picking and delivery.

Read our blog on shipping aggregators to better understand how they can complement warehousing facilities to enhance your fulfillment services to your customers.

Inventory Tracking

Some pain points of traditional warehouses include missing, damaged, or wrong item cases and all of this arises due to a lack of proper inventory tracking mechanisms. Some

warehouses still tend to operate with pen-and-paper processes, which results in a lot of manual errors.

In the case of eCommerce warehousing, they are usually led by technology. This enables them to track every aspect of inventory management which reduces manual errors to a great extent and some services also provide fulfillment status services to both the retailer and customer. Moreover, the orders are tracked at the customer level, and customer feedback is immediately mapped to the order to take corrective and preventive actions in case of any errors.

3.3 E-Commerce Warehousing With a 3PL: How Does it Make Your Life Easier in 2023?

3PL companies often provide features and facilities in their warehouses that companies simply could not obtain on their own without spending a significant amount of capital in doing the research and implementing the technology. It is always easier for eCommerce companies to partner with a 3PL so that they can take advantage of the wide range of benefits on offer. Additionally, these services are often very cost-effective because 3PL companies do their best to win over customers from the competition by gaining their attention with attractive pricing. Some of the reasons that eCommerce companies should opt for eCommerce warehousing with a 3PL company are:

- Access to advanced technology such as WMS
- Ability to automate multiple important warehouse processes
- Mitigation of errors and accidents
- Use of smart inventory placement to strategically place inventory
- Access to cheaper and more transparent pricing
- Reduction in time and effort in order fulfillment
- Access to ultra-fast delivery
- Choice of a variety of shipping aggregators
- Access to multiple warehouses and fulfillment centers across the country
- Specialised features such as cold storage and climate-control facilities

3.4 MAIN FACTORS OF E-COMMERCE WAREHOUSING SERVICE

The choice of which eCommerce warehousing service is right for your business is determined by many factors such as ownership, network design, cost, and service levels. If the company plans to own the warehouse, network design comes into the picture. The number of warehouses relates to the appropriate level of service for the clients. For example, if there is only a single warehouse for the whole country, it will have a negative impact on the delivery timelines of goods to the customer.

In the case of owning the warehouse, it also becomes a tedious task to strategize ways for efficient management while scaling the organization. In most cases, retailers partner with warehousing organizations that already have the necessary infrastructure to support scale. Here are the best practices for selecting an eCommerce warehousing service;

Count of Warehouses

The number of warehouses possessed by the eCommerce warehousing service and their locations plays an essential role in determining viability. eCommerce companies need to be clear on where they want the warehouses to be located to maintain a steady supply of goods and maintain customer relationships.

Capacity of Warehouses

eCommerce warehousing services have a defined capacity. It is always essential to understand the companies' capabilities and ensure it aligns with the eCommerce warehousing service before deciding to partner with them.

Capability of Warehouses

eCommerce warehousing capabilities broadly include faster shipping times, better inventory management, tracking capabilities, transport partnerships, cold storage facilities, technological advancement and much more.

Cost of Warehouses

Even though the costs of maintaining a warehouse do not fall directly under eCommerce companies now, they need to consider other expenses like storage cost per day, the transaction cost for shipping, etc.

Client Base of Warehouses

The existing client base of eCommerce warehousing services speaks volumes about their capabilities and offerings. It is easier to evaluate them based on customer reviews.

Communication of Warehouses

Communication serves two purposes. In the case of newer warehousing and storage services that are entering the market, it is difficult to evaluate them based on their clientele, as they have fewer clients that can speak on behalf of the eCommerce Warehousing service that they have partnered with. During such situations, the timely communication practised by its operators plays a crucial role in determining their services. Also, expecting accurate analytics such as reports of inventory stored and on-time deliveries is vital for eCommerce businesses to measure the performance of their supply chain.

Most eCommerce storage and warehousing services give clear ideas about their services and work as partners to enable the growth of their partner organizations. The eCommerce companies need to pick and choose the right fulfillment partner and scale from there.

Read our blog on logistics costs to get an idea of what expenses an eCommerce retailer incurs and how to mitigate them.

CHAPTER 4
MATERIAL HANDLING AND WAREHOUSING
SAFETY

INTRODUCTION

Material handling and warehousing safety refers to the set of practices and protocols aimed at preventing accidents, injuries, and fatalities that can occur during the movement and storage of goods. It involves ensuring that workers are properly trained, equipment is well-maintained and operated safely, loads are properly secured, facilities are well-lit with clear pathways and emergency exits, ergonomics are optimized to minimize physical strain, hazardous materials are properly handled and stored, and regular safety audits are conducted to identify potential hazards. Implementing these measures can help ensure the safety of workers and prevent accidents and injuries in material handling and warehousing operations

Material Handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. As a process, material handling incorporates a wide range of manual, semi-automated and automated equipment and systems that support logistics and make the supply chain work

Product movement

Movement of Goods is the process by which goods are transferred from one place to another in order to facilitate the availability of product where it is required. This is a term referring to the logistics industry where goods are transferred from the source to the destination which can be from one factory to a port to another in case a company orders a raw material or the other way round when a manufactured product is transferred from our company to some other company.

Product load activity

A company's economic activity will determine the type of warehouse it needs. Similarly, although all warehouses share common characteristics, the product to be stored will determine the design and construction of both the warehouse and the installation of storage systems. Types of load

1. Bulk load

This is the load that is not recorded in units, but rather by mass and volume criteria, since these are goods prepared for transportation directly, where the means of transport itself acts as a container, generally

specialized containers.

In other words, these goods travel loose, without any packaging. For example, coal, sand, ore etc.

Small loads

These are loads that can be carried in one hand and that are generally unified in a single package. For example, cartons of juice or packs of beer.

2. Medium loads

They are slightly bigger than the above loads and may weigh up to 10 kg, but they can still be carried by hand.

3. Large or pallet loads

These are larger goods which require standardized packaging and are grouped on a pallet for handling. This type of load cannot be handled manually, but by mechanical means such as forklifts, etc.

The pallet load can be stored with a wide variety of storage solutions. Everything will depend on the function of the warehouse, the type of product, the available area, etc.

DISPATCH ACTIVITY One of the functions of a warehouse is to dispatch goods. The goal of this stage is to ship products ordered by customers so that they leave the installation and are delivered at the agreed-upon time and in perfect condition.

The goods dispatch process is divided into various phases. Different tasks are associated with each one to ensure a successful outcome.

4.1 WAREHOUSING SAFETY

Material handling and warehousing safety are critical aspects of any business that involves the movement and storage of goods. Failure to implement proper safety measures can result in accidents, injuries, and even fatalities. Here are some key considerations for ensuring safety in material handling and warehousing:

Proper training: All workers involved in material handling and warehousing should receive appropriate training on safety procedures, equipment operation, and emergency response.

Equipment safety: All equipment used in material handling and warehousing should be inspected regularly and maintained properly. Operators should be trained on safe operation procedures, and safety features such as guards and emergency shut-offs should be in place.

Load safety: Loads should be properly secured and distributed evenly to avoid tipping or instability during movement. Workers should also be trained on proper lifting techniques to avoid back injuries and other strain-related injuries.

Facility safety: Warehouses should be well-lit, with clear pathways and emergency exits. Fire safety measures such as smoke detectors and fire extinguishers should also be in place.

Ergonomics: The design of workstations, tools, and equipment should be optimized to minimize physical strain and reduce the risk of musculoskeletal disorders.

Hazardous materials: Proper handling and storage procedures should be in place for hazardous materials, including proper labelling and storage away from other materials.

Regular safety audits: Regular safety audits should be conducted to identify potential hazards and address any safety concerns.

Implementing these measures can help ensure the safety of workers and prevent accidents and injuries in material handling and warehousing operations.

4.2 MATERIAL HANDLING

Effective material handling is the centre of all operations for many large companies. Their operations' safety and success significantly depend on transporting materials, work in progress, and finished goods from one area of the facility to another. Furthermore, it is critical to ensure timely order fulfilment, which leads to customer satisfaction.

In addition, the material handling process involves the movement, protection, storage, and control of materials. This handling process occurs in the following industries:

- manufacturing shop floors
- warehousing and distribution
- automotive and aerospace
- food and beverage
- E-commerce and retail
- construction and hardware
- consumer goods and electrical appliances
- hospitals and pharmaceuticals
- chemicals, paper, and plastics
- material disposal

Ensuring safety in workplaces where material transportation occurs is also a growing need across most industries. Efficient material handling processes can reduce accidents significantly.

4.3 MAIN TYPES OF MATERIAL HANDLING

There are two main types of material handling that operators and company owners need to know. And here they are:

01. Manual material handling

Manual material handling is where workers use their hands in moving individual containers. They lift, lower, fill, empty, or carry the containers when transporting them. However, this can be hazardous for workers since it exposes them to physical activities where they can be injured.

In most cases, workers suffer from sprains and strains in their lower back, upper limbs, and shoulders. Fortunately, there have been ergonomic developments made to reduce the risks in the manual handling of containers.

So, manual material handling carts refer to handling solutions that are operated and moved manually. These carts are generally equipped with wheels and handlebars for moving and steering the cart.

They are the most commonly used carts and can be found in every industry.

02. Automated material handling

Equipment is used in reducing or replacing manual handling of materials when economically and technically feasible.

In fact, many of the material handling machines available today are semi-automated due to human operator needs such as driving, unloading, or loading containers that are challenging and expensive to automate. Thanks to the ongoing improvements in machine programming, sensing, and robotics, there is a move to completely automate the handling of materials.

Automated material handling solutions include:

- **Automated guided vehicles (AGVs):** Automated guided vehicles are driverless electric vehicles used to transport materials within a facility. AGVs follow set paths using various navigation technologies. They also have collision warnings, enabling them to detect obstacles and stop.
- **Autonomous mobile robots (AMRs):** Autonomous mobile robots are equipped with advanced navigation technology, enabling them to map out a facility and determine their path as they move. They have developed sensors that allow them to identify obstacles and navigate around them.
- **Conveyors systems:** Conveyors are popular material handling solutions in many facilities. They effectively move goods quickly while minimizing the risk of damaging materials.

– **Automated storage and retrieval system (AS/RS):** An AS/RS is a computer-controlled system that automatically stores and retrieves materials with precision, accuracy, and speed.

4.4 ABC ANALYSIS

ABC analysis is an approach for classifying inventory items based on the items' consumption values. Consumption value is the total value of an item consumed over a specified time period, for example a year. The approach is based on the Pareto principle to help manage what matters and is applied in this context:

- A Items are goods where annual consumption value is the highest. Applying the Pareto principle (also referred to as the 80/20 rule where 80 percent of the output is determined by 20 percent of the input), they comprise a relatively small number of items but have a relatively high consumption value. So, it is logical that analysis and control of this class is relatively intense, since there is the greatest potential to reduce costs or losses.
- B items are interclassing items. Their consumption values are lower than A items but higher than C items. A key point of having this interclass group is to watch items close to A item and C item classes that would alter their stock management policies if they drift closer to class A or class C. Stock management is itself a cost. So there needs to be a balance between controls to protect the asset class and the value at risk of loss, or the cost of analysis and the potential value returned by reducing class costs. So, the scope of this class and the inventory management policies are determined by the estimated cost-benefit of class cost reduction, and loss control systems and processes.
- C items have the lowest consumption value. This class has a relatively high proportion of the total number of lines but with relatively low consumption values. Logically, it's not usually cost-effective to deploy tight inventory controls, as the value at risk of significant loss is relatively low and the cost of analysis would typically yield relatively low returns.

Since businesses are not all the same, the thresholds that define the upper and lower limits of each class are not definable. Nor will they necessarily be fixed over time or across all locations. A business may have different risk appetites between different locations. For example, a location in a high-crime area may have a higher proportion of A items or, where a facility is less secure, more items may be classed as A. The management accountant should carry out risk and stock management cost-benefit analyses by location to deliver the optimal overall cost-benefit balance and to set the ABC ranges.

CLASS	ITEMS	CUMULATIVE	CONSUMPTION VALUE	CUMULATIVE
A	20%	20%	70%	70%
B	30%	50%	>20%	90%
C	50%	100%	10%	100%

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CHAPTER 5
TYPES OF WAREHOUSE STORAGE

Storage

Warehouse storage is usually of either the bulk or rack variety, where bulk storage pallets are typically just stored on a floor and where rack storage pallets are stacked on racks to make use of higher ceiling space. Typical rack warehouse storage equipment includes pallet racks and wire decking, heavy-duty shelving, cantilevered racks, reel racks, and, sometimes, high-density storage systems such as drive-in racking, push back racking, and pallet flow racking. High-density systems are sometimes able to increase the usage of existing space enough that the need for building additional storage facilities can be avoided. Inventory systems such as FIFO (first in, first out) have some bearing on which of these high-density systems are suitable. Aisle space is referred to as narrow aisle (NA) or very narrow aisle (VNA) and can place a limit on lift maneuverability. A typical counterbalanced lift truck needs at least 11 ft. of aisle width to turn around. Three-wheel pallet jacks are often employed in warehouses due to their improved ability to navigate through tight corridors.

Transfer and Handling

Moving material around a warehouse involves lifts and trucks of many kinds, such as pallet jacks, lift trucks, hand trucks, scissor lifts, stackers, etc. Special designs such as narrow-aisle forklifts are available for high-density storage schemes. Wire- or rail-guided reach trucks are sometimes employed in narrow-aisle warehouses to maximize the use of storage space. Such automation, known as automated storage and retrieval, can reduce personnel requirements – at a cost. Often, such systems use horizontal or vertical carousels for the storage of stock. Special attachments are available for forklifts for handling unpalletized loads such as paper rolls or storage drums.

Conveyor systems of various kinds are also employed in some warehouses for the movement of picked goods. Both gravity and live roller conveyors are common as are skatewheel conveyors. Temporary, flexible conveyors are sometimes used as well. See related guides Understanding Conveyor Systems and Types of Trucks and Carts for additional information on transfer and handling equipment.

Picking/Packing/Palletizing

Picking operations can be done order-by-order, called discrete picking, or simultaneously on multiple orders, also called batch picking. Zone picking is another method, where multiple pickers work on the same order for later assembly. When whole pallets are pulled from racks it is called pallet, or unit load, picking. Case picking refers to removing cases of like products. Piece picking, or broken-case picking, describes the picking of individual items as might apply to a mail-order catalog operation or a repair parts distributor.

Order picker forklifts are designed to elevate both pallet and operator to the level of racked goods, a so-called man up operation. For bulk storage warehouses, case picking usually involves a manual or electric pallet jack that the picker moves from location to location as the cases making up the order are selected. Palletized orders may be stacked using pallet positioners for better worker ergonomics. Palletized loads are stabilized with bands or shrink-wrap applied manually or by machine. Loads are then trucked to loading docks and into trailer containers. Here, a variety of equipment is in service, including trailer leveling jacks and chocks, dock plates, dock seals, and air curtains. Automated restraint systems reduce the chance of a truck pulling away from the dock as it is still being loaded. Elevating docks are used where raised docks are unavailable. Signals provide communication to truck drivers and lift operators.

Operations

Warehouse management such as keeping tabs on materials and goods moving to, from, and through a warehouse is often aided by the use of mobile workstations and handheld devices. With such equipment available to them, warehouse workers are able to move throughout the warehouse and have necessary data such as pick lists immediately at hand. Barcoding and RFID tags are used to further streamline the process. Warehouse management software is used to track the flow of goods through a facility, including receiving, putaway, picking, shipping, and inventorying. Such software is sometimes used to initiate slotting, the arranging of stock within a warehouse to improve picking efficiency. Regardless of the picking method or the nature of the picking (piece, case, pallet), a rule of thumb says that the items moved most frequently should be stored closest to the pick point to minimize transit times, which make up a large portion of most picking cycles.

In-plant offices and mezzanines can be set up for office personnel and for additional use of warehouse space. Lockable storage in the form of security cages is also available.

Worker safety is a primary concern in a busy warehouse. Racks are often buttressed at their ends to protect them from forklift collisions. Racks are usually fenced or enclosed along one side to avoid boxes from being pushed through and falling during handling. Many lifts are equipped with overhead guards to protect operators against injury from falling stock. Pickers wear appropriate harnesses to protect them from falls.

Some warehouse operations skip the putaway step and goods move from receiving directly to shipping. This process is called cross-docking and it is employed mainly in warehouses and distribution centers involved in the retail trades.

1. Storage Cabinet

Like in a household, storage cabinets are high-density steel storage containers that offer quick access to the inventory and are an easy and convenient way of storing goods. These storage cabinets are typically used to accommodate bulkier items. A single type of storage system will not be enough for a warehouse, as the supplies and equipment stored in different warehouses vary greatly. You would need to use different storage cabinets and storage systems to store various kinds of inventory effectively.

2. Pallet Racks

Pallet racking is one of the most common forms of warehouse racking systems. Pallet racks are storages designed to stack materials(SKUs) in horizontal rows with multiple levels. The pallet racking system's benefit is simple – why spend more money adding extra space in the warehouse when you can utilize the vertical space? These racks are topped with pallet, and forklifts allow for movement between the racking systems that add efficiency to warehouses.

There are different types of pallet racks that warehouses employee

3. Multi-tier Shelves

Multi-tier shelving is the construction of shelves or racks on more than one level. Multi-tier shelving provides storage space at multiple levels, thus maximizing the utilization of vertical space available in a warehouse, making it easier for businesses to store more of

their inventory, thereby increasing the warehouse's capacity as a whole. This system is an excellent choice for large stocks of items that have small unit sizes.

Each level of the multi-tier storage can be accessed by staircases, main aisles, and cross aisles. Mostly, multi-tier racking concerns relatively lightweight items that are picked and organized manually. To get the most out of this warehouse storage system, organize each tier strategically and pack items as densely as possible while at the same time paying attention to weight limits and ceiling-to-rack height compliance guidelines.

Selective Pallet Racking

It is the most common pallet racking system and comes in two configurations: roll-formed or clip-in configuration and a structural bolt-together configuration. Pallets rest on horizontal load beams held in place with mounting clips and can be moved quickly and easily adjusted to accommodate differing load sizes.

Push-Back Pallet Racks

These are used to maximize storage space at the cost of reducing aisle space. Push-back pallet racks are often used to maximize storage space at the expense of lowering aisle space. Each bay is displayed up to six pallets deep and stored on wheeled carts fitted onto rails. A forklift can set the pallet onto the cart, drive forward and bump into the next pallet, rolling the entire group backward to maximize storage space

4. Mezzanine Flooring

A warehouse mezzanine floor can yield a massive amount of extra storage space. Effectively, you're just constructing a second floor above existing aisles, which provides extra shelving space, working areas for staff to pick and pack or check and move stock on. Mezzanines don't always need to be restricted to a single level; they can provide two or even three extra levels.

Mezzanine flooring technology has advanced in recent years, with a whole variety of custom designs to offer. Because of these advances, virtually all mezzanine flooring is custom designed and fitted to integrate with most storage situations in almost every warehouse situation.

It's best to use a company that can manage the whole process for you – from designing and installing mezzanine systems to advising on how you should fit out and make the best use of your additional space.

5. Static Shelves

As the name suggests, shelves are used to keep the goods and products static – they aren't movable and stay in one place. They are designed in a way that they can store lightweight inventories that have to be handpicked or placed. This type of storage is not compatible with forklifts and has to be done by hand.

6. Mobile Shelves

It is similar to static shelving, but the only difference is that it can move and offers adjustable shelves. Such systems are designed to accommodate more goods in less space. Some of them can also contain locking systems and level tracks. The level tracks can either be mechanized or manual.

7. Wire Partitions

Wire partitions are secure wire cages, and sections are an essential accessory for improving warehouse security. They are typically made of fence-like wire mesh materials, creating a durable and robust enclosure that makes it easy to designate high-security storage areas or sections within your facility. Wire partitions are also practical additions as they help you section off areas without investing in major renovations.

SWOT ANALYSIS ON DHL

DHL Strengths 2021:

- **7. Worldwide Coverage.**

DHL is a leading multinational brand with strong global coverage in the international logistics market. According to DHL (2021), DHL is currently working in more than 220 countries all across the world. Around 49 million letters are delivered every day to the customers. This shows that DHL is successful to cover a major portion of the market share due to its worldwide coverage.

- **Technological Innovations.**

DHL is heavily involved in making technological innovations over the introduction of advanced technologies in the market. In 2021, DHL has launched a new service that enables retailers to expand their online presence by expanding into a wide range of items, such as kitchens, beds, and furniture. It will allow consumers to get the same home delivery services just like other suppliers, to ensure a satisfactory brand experience DHL (2021a). In addition to this, in 2019, DHL also launched a central procurement system and e-procurement, allowing people to buy and sell supplies online (Post and Parcel, 2019).

- **Strong Brand Value.**

DHL has a strong brand reputation in the international market. According to Interbrand (2020), the brand value of DHL was estimated at \$6.29 billion in 2020, with the 81st ranking in the Best Global brands 2020. Moreover, based on Fortune (2021), DHL is ranked 113 among the Global 500 brands with an \$85 billion market value.

- **Excellent Financial Position.**

DHL holds a strong financial position with an ample number of resources to back up its operations. DHL has a gross profit margin of 51.4% and net profit margins of 4.3% in 2020 (Macrotrends, 2021), showing that the company has a good financial position. Moreover, its current ratio has increased from 0.89 to 1.1 in 2020 (Macrotrends, 2021), showing that it is now capable to meet its liabilities in a better way.

DHL Weaknesses 2021:

- **Weak Marketing Strategies.**

Unlike its rivals, such as UPS or FedEx, DHL has poor marketing and advertising tactics. It does not put a lot of money into branding, which has an impact on brand acceptability and appeal. Therefore, DHL needs to give focus on improving its marketing strategies.

- **Dependence on External Collaborations.**

Although DHL is a multinational company with a strong market presence globally, it has to collaborate with local private agencies or companies to operate on gross levels, which does not provide full control to the DHL on the services provided to the customers. Therefore, it affects the overall efficiency and repute of the brand, leading to lower sales.

- **Multiple Regulatory Compliance.**

DHL operates in a variety of countries, leading to the compliance of multiple regulatory requirements to operate in a specific country. This puts difficulty on the DHL to follow different laws and fulfill different requirements to run its operations. In case of any new sanctions in a country, DHL revises its operational plans, accordingly, which put extra cost and effort (DHL, 2021b).

DHL Opportunities 2021:

- **Collaboration with Chinese Company.**

China is considered an ocean of opportunities for any business. DHL has

recently announced a partnership with Shopee, a leading Chinese e-commerce platform, in order to allow Chinese sellers to access worldwide consumers (DHL, 2018). Therefore, DHL has become the largest express mail service company in China, contributing a significant amount of revenue to the total revenue.

- **Global Expansion.**

DHL is currently operating in above 220 countries all across the world, but the company has the potential to further expand its services to the small cities of these countries. DHL can build mail centres, postal boxes, and parcel centres, in order to increase its market share. According to IMARC (2021), the global logistics market has reached US\$ 5.2 trillion in 2020, which is expected to further grow by 4.6% by 2026, which provides a huge opportunity for DHL for expansion.

DHL Threats 2021:

- **Highly Competitive Market.**

The global logistics sector is highly competitive, forcing companies to fight for gaining and retaining their market share. According to BixVibe (2021), DHL (Deutsche Post) has managed to contribute 21.7% of the global revenue earned by the logistics company, by being on the second number. While other companies, such as UPS and FedEx are also holding higher shares, 23.2% and 21.2%, respectively, which may cause a threat to DHL in expanding its sales in the future.

- **Growing Electronic Communication Means.**

Owing to the latest technological advancements for communication, traditional services, such as posts and letters have faced a significant downturn. People now prefer to use emails or social media platforms to send their messages and even send electronic cards to their loved ones, rather than using traditional methods, due to its free-of-cost and fast service.

CONCLUSION

Storage warehouse and material handling are essential components of logistics and supply chain management. The effective management of inventory and the movement of goods within a warehouse is critical to ensuring the timely delivery of products to customers while minimizing costs and maximizing efficiency.

In conclusion, a well-designed storage warehouse and efficient material handling systems can help businesses to streamline their operations, increase productivity, and reduce costs. With the right equipment, technology, and processes in place, organizations can improve inventory management, optimize space utilization, and reduce the risk of product damage or loss. As such, investing in storage warehouse and material handling systems can lead to significant benefits for businesses of all sizes and industries.