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STUDY MATERIAL FOR B.B.A (SL)

WAREHOUSE AND INVENTORY MANAGEMENT

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UNIT- I

WAREHOUSE AND INVENTORY MANAGEMENT

Introduction to warehouse management

Warehouse management encompasses the principles and processes involved in running the day-to-day operations of a warehouse. At a high level, this includes receiving and organizing warehouse space, scheduling labor, managing inventory and fulfilling orders. Zoom in closer and you'll see that effective warehouse management involves optimizing and integrating each of those processes to ensure all aspects of a warehouse operation work together to increase productivity and keep costs low.

Types of WMS

The implementation of a Warehouse Management System is required by every organization which deals with physical goods that must be transported according to clients' demands. Time is money, and if your employees don't have an effective system to handle warehouse operations, you could be losing money. Determine which warehouse management system is appropriate for your company, so you don't fall behind on inventory control, picking, and shipping orders.

1. **Standalone WMS**

   A standalone WMS is a type of on-premises system with standard software placed on the company's local hardware and network. Many WMS programmes are third-party packages that must be integrated with the rest of the company's management software (such as the ERP system). It's perfect for small firms with low software budgets.

2. **Supply chain modules**

   Supply chain management system development technology is much broader in scope and can help customers manage numerous aspects of supply chain visibility. The fundamental goal of supply chain management is to automate the monitoring of inventory replenishment, inventory cycles, material acquisition, and other everyday tasks. Risk analysis, current market activities, and vendor partnerships can be accommodated. It is perfect for

businesses that are small to medium-sized and corporations with numerous supply chains.

3. Integrated ERP systems

ERP or Enterprise Resource Planning is software that tracks all of a company's or organization's resources. In addition to core applications like human resources software systems, sales and marketing, finance and accounting, and CRM solutions, some ERP programme innovations include a WMS software or SCM module incorporated into their ERP system. It is a good fit for businesses of all sizes and with a wide range of client requirements.

4. Cloud-based WMS

Cloud-based WMS is a web-based, centralized-computing approach that uses cloud technology. Cloud-based system development is also known for its scalability and deployment speed. It can provide the same benefits as a traditional WMS while allowing for faster chain execution and cheaper inventory expenses. Because they are web-based, the cloud-based warehousing application does not require installation or synchronization with native hardware or networks. It is the perfect pick for businesses of all sizes and many locations.

Decision and operations in Warehouse

Decision Warehouse is a tool of the Rule Execution Server console for monitoring rule set execution. It stores execution traces in a database. The execution trace contains information about how a decision was made. It records the rule flow, the path of rule flow tasks, and the rules that were executed. These details are intended to help users, an auditor for example, understand what happened during the execution process. Users can access Decision Warehouse in the Rule Execution Server console. The goal is to provide business users with data from which they can generate reports. You use business reports to measure how well a business is running.

Audits of executed decisions: With Decision Warehouse, system administrators and auditors can view and manage stored decisions and traces.

Default use of Decision Warehouse: You can use the default Decision Warehouse to store the trace of a rule set execution.

Customizing Decision Warehouse: You can configure and customize Decision Warehouse to go beyond the built-in capabilities.

Important warehouse processes

1. **Receiving**

   To perform the receiving process properly, the warehouse should be able to verify the product, its quantity, and condition, and at the right time. Failing to do so will have consequent impacts on all subsequent operations. The aim of enhancing the warehouse receiving process is to receive goods efficiently and correctly. Finally, software such as advanced warehouse management systems allows you to assign the right sum of workers properly by accurately anticipating upcoming deliveries.

2. **Put-Away**

   Deteriorating to place goods in their ideal location can ruin the productivity of warehouse operation. When goods are put-away properly, there are several benefits:

   - Safety of goods and staff is ensured
   - Maximize warehouse space utilization
   - Easily track and trace goods
   - Store goods efficiently, and properly
   - Minimize travel time

   The purpose of optimizing the putaway process is to transfer goods for storing to their most ideal location in a fast, efficient, and effective manner. Advanced warehouse management systems automate assigning optimal spaces for each good, utilize the putaway process and maximize space utilization.

3. **Storage**

   Improving your storage process is only possible when the right KPIs are properly track. Advanced warehouse system automatically calculates your warehouse storage utilization and tracks the right storage KPIs will allow you to determine how efficient each aspect of your storage process is.

4. Picking

Streamlining the picking process helps to focus on achieving higher accuracy, as errors can have a direct impact on your customer satisfaction. Advanced warehouse system helps to optimize the picking process by allowing workers to view picking lists wirelessly, access systems in real-time, and scan anywhere in the warehouse. In addition, other viable options include conducting an ABC analysis to improve your warehouse layout.

5. Packing

One of the primary tasks of packing is to minimize damages from the time items leave the warehouse. Additionally, packaging must be lightweight to reduce packaging costs. Optimizing the packing process can be done by utilizing software to guide people in executing the tasks.

6. Shipping

Shipping is considered successful only if the right order is sorted and loaded, dispatched to the right customer, travels through the right transit mode, and is delivered safely and on time. To optimize the shipping process, having software systems to streamline many of the tasks is critical. Meta WMS, an Advanced Warehouse Management System allows allocating the right amount of resources to prevent over or under allocation.

Factors to consider while choosing a location for the warehouse

There are many factors affecting warehouse location but there are certain critical pointers that one should always consider:

1. Structure and layout of the building

The optimal way to structure, the building is to design it according to the activities that will be taking place inside the organization. You should always keep in mind that an old building could not sustain the flow of raw materials. Whereas a newer building can maintain a smooth flow in carrying materials. Certain factors affect or restrict certain equipment accommodations. The factors are most likely related to ceiling heights or column spacing, etc. This can also harm the inward and outward flows of raw material and finish products.

2. Availability of trained workers

Getting a building at a certain remote location will obviously come at an effective price rate but at the same finding trained workers in such a place will not only be difficult but also very challenging. On the other hand, if you think of shifting your whole bunch workforce to a remote location it will cost a lot of money. Either way, it will lead to an unsustainable failure of the organization. Therefore, it is advisable to purchase your warehouse in a certain area that can provide you with an adequate workforce with various skills. This will help you hire workers for all kinds of activities related to your organization.

3. Customer base and zoning

While considering this factor you need to determine the intensity of the operations that are going to be conducted in the organization and what future it holds. If your organization requires light assembly, then you can ahead with choosing a location with much lesser intensive use. However, some other factor that can also affect the zoning is noise levels, emissions, and outdoor storage availability. These elements also target the districts that you will consider for conducting future operations.

4. Accessibility to major linkages

Transportations means are very important when it comes to business organizations. Any default, in this case, can lead to huge business losses and delays in delivery, which also leads to customer dissatisfaction. Other than transport, you should also consider another factor that is accessibility to your targeted customers. Customers are the reason why everyone does business. Without customers, there is no meaning to a business. Therefore, while choosing a location, you should also keep in mind that you are easily accessible to the customers.

5. Material handling capacities

Another Selection criteria for warehouse location that you need to consider is the material handling capacity of the location is the availability of staging capacities and handling equipment. For instance, if a truck is a primary model, then you need to make sure that you have the depressing docks. You need to identify whether there is a need for internal docks. The highly intensive distribution will certainly require cross-docks. You need to

determine whether the building has enough storage facilities. This will help you identify the material handling capacity of your warehouse.

6. **The size of your warehouse**

The size of the warehouse is a definite criterion that you will have to consider no matter what. The whole inventory stock and the flow of the raw materials depends upon this. With these, you can determine what and how much your inventory you can accommodate in the building. This is also linked with the material handling capacity. The material handling capacity to some extent depends upon the size of the warehouse. Your warehouse should be capable enough to accommodate the required equipment and inventories according to your business needs. For every startup business or company, it is very essential to determine whether there is enough space for further expansion in the future. This will save you all the time and money when your business at a high peak of success. You do not have to worry about the space then if you already have enough room, to begin with.

7. **Rules and regulations**

Before you go on buying the warehouse, you should be aware of all the rules and regulations along with the legal aspects prevalent in that particular area. Many areas do not allow the storage of certain items. It is always recommended to avoid the goods that are not allowed to avoid any future problems. You should abide by the rules and regulations of the area if you want to conduct a hassle-free and successful business in that particular area.

8. **Taxes and rent rates**

The cost has to be a critical criterion when it comes to selecting an accurate location for the warehouse of the organization. There is a certain hidden cost that negatively influences the cheap lease rates and therefore the factors relating to cost should always be considered in any aspect of the business.

9. **Market and environmental factors of the locality**

Proximity to market, producers, and suppliers that are being served along with environmental factors of the area should be considered. Any new warehouse that is set up should be close to important customers, suppliers, and producers. This will decrease the transportation costs, reduce the lead times considerably, enhance responsiveness, etc. the main factor is to

determine who are the important supply chain personnel and to make the particular supply chain efficient for Warehouse location planning**.**

Principles to Consider While Designing Your Warehouse Layout

Considering the principles below can help you design an efficient layout and streamline warehouse operations. Here are some of the most crucial factors to consider:

1. **Budget Considerations**

   Before starting with the design of your warehouse layout, it is essential to assess all your business requirements, review associated budgets, and then plan the layout accordingly. During this process, you might come across some layout designs that are more comprehensive and expensive than others, but it is recommended that you consider the most suitable and cost-efficient solution for your warehouse.

2. **Space Available**

   Effectively utilizing the warehouse space available can help improve inventory visibility, reduce travel time, and increase overall operational efficiency. When designing your warehouse layout, it is crucial to allocate maximum space to storage and inventory processing purposes while minimizing space for office areas, empty pallets, charging stations, etc. Additionally, how you decide to allocate space will impact shelving designs, installation capacity, and placement of goods inside your facility.

3. **Flow**

   Ensuring the uninterrupted flow of goods, personnel, and equipment is vital to consider in the design layout for the smooth functioning of your warehouse. You can avoid inefficient routes and disruptions by strategically planning your warehouse layout design so as to facilitate each operation in a sequential manner.

4. **Accessibility**

   While planning your warehouse layout, it is crucial to ensure easy accessibility to all the areas and products in your facility. The layout should be designed in a way that makes it easy for personnel to navigate throughout the facility while conveniently locating and picking items without having to

move other products. As a result, your productivity can be enhanced and orders can be fulfilled at a faster rate.

5. **Equipment**
   The use of different types of equipment in your warehouse, such as lifting & packing tools, pallet racks, or conveyors, can influence the layout design. By identifying the equipment needed, you can evaluate and design the most suitable layout according to your requirements and boost the productivity of your facility.

6. **Throughput**
   Throughput in a warehouse refers to the number of products that are processed and moved through various warehouse processes such as receiving, put away, storage, picking, packing, and shipping. By collecting and analyzing this data, you can design a layout to ensure an efficient flow of goods and accommodate the necessary equipment for your warehouse.

7. **Personnel**
   Knowing the number of people required, their current levels of training and shift timings, and other related factors can help you design your warehouse layout in a way that doesn't limit your workforce's productivity. Also, the layout must be planned in a manner that can safely accommodate new employees and their needs in the future.

8. **Authority Guidelines**
   While designing your warehouse layout, it is critical to comply with the guidelines provided by the local authorities. Abiding by these guidelines not only ensures the safety of your workers, equipment, or other valuable assets but also helps you avoid fines and legal problems for your business.

Importance Inventory control

1. **Cash Flow**
   Inventory control and planning allows small businesses to manage their cash flow opportunities. SMEs aren't always able to purchase large amounts of inventory, due to limited capital. By having better control of their inventory, they can know exactly how much inventory they will need and when they

need it. This can free up other capital to re-invest in other areas of the business.

2. **Business intelligence**
An inventory control and planning solution allows small businesses to gain insights into the fast-selling products. This allows them to adjust their product line and to make quick and smart business decisions.

3. **Maximize profits**
By being able to make better business decisions the inevitable outcome for a small business will be an increase in profits. This is because the stock in their inventory will only be stock that's actually selling. Other stock that doesn't grab customer's attention can be deemed obsolete and can be abandoned. This makes the general business practice more efficient.

4. **Limits employee mishandling**
Inventory planning and control limits the ability of employees to steal from the inventory. Often employees use items from a business' inventory for personal use. Without inventory control, the business owner would be none-the-wiser. This practice ultimately reduces the profitability of the business. By limiting the ability of the employee to steal, the employer is reducing potential 'hidden' costs.

5. **Reduce labor costs**
Improved inventory planning and control techniques allow small businesses to reduce labour costs associated with inventory. These include the time spent counting stock and the transportation of stock. Employing an intelligent inventory planning and control solution can significantly reduce all these labor-intensive activities.

Scope of Inventory Control

1. **Determination of economic order quantity:**
Economic order quantity or economic lot size refers to that number ordered in a single purchase or number of units should be manufactured in a single run, so that the total costs — ordering or set up costs and inventory carrying costs are at the minimum. So, the determination of E.O.Q. is also within the scope of inventory control.

2. Formulation of policy:

The policies of investment procurement, storage, handling, accounting, storages and stock outs, deterioration, obsolescence etc. are to be formulated under the scientific system of inventory control. What, when and how much of purchasing and fixation of minimum and maximum levels is also to be determined for a given period of time.

3. Determination of lead time:

By lead time is meant the time that lapses between the raising of an indent by the stores and the receipt of materials by them. Lead time is of fundamental importance in determining inventory levels.

4. Effectiveness towards running of store:

The determination of policies of the location, layout and materials and storage handling equipment certainly help in the effective working of stores organization.

5. Organization structure:

After determining of inventory policy, the next step is to decide the location, layout and types of storehouse. It facilitates the movement of materials and thus minimize the storage and handling cost of stores.

6. Determination of safety stock:

Safety stock is defined as the difference between the amount stocked to satisfy demand during a certain time interval and the mean expected demand for that period. It is for the purpose of providing protection against depletion. If demand remained constant and lead tin-; is invariable, there would be no fear of shortages and no need for safely stocks.The exact quantity of safety stock of an item depends upon its lead time, usage value, and variability of lead time demand, carrying charges and the importance of its stock out cost. Again, determination of buffer stock reserve stock is included in the management of inventory.

7. Minimum material handling and storage cost:

Stores organization activities are arranged in such a manner that the east of bringing in the store house and issuing from the store house if the various stores, will minimize the storage and materials handling cost of stores**.**

Types of Inventory

1. Raw Materials

Materials that are needed to turn your inventory into a finished product are raw materials. These inventory items are bits and pieces of component parts that are currently in stock but have not yet been used in either work-in-process or finished goods inventory. There are two types of raw materials: direct materials—which are used directly in finished goods, and indirect materials—which are part of overhead or factory costs.

2. Work-In-Process

Inventory that is being worked on is Work-In-Process (WIP), just like the name sounds. From a cost perspective, WIP includes raw materials (plus, sometimes labor costs) that are still "in production" when the accounting period ends. In other words, whatever direct and indirect raw materials your business is using to create finished goods is WIP inventory**.**

3. Finished Goods

Maybe the most straightforward of all inventory types is finished goods inventory. That inventory you have listed for sale on your website? Those are finished goods. Any product that is ready to be sold to your customers falls under this category.

4. Overhaul / MRO

Also known as Maintenance, Repair, and Operating Supplies, MRO inventory is all about the small details. It is inventory that is required to assemble and sell the finished product but is not built into the product itself. Depending on the specifics of your business, this inventory might be in storage, at a supplier, or in transit out for delivery.

Selective Inventory Control

To identify items, which bring significant benefit by proper management from among hundreds and thousands of items managed by an organization Determine the importance of items and thus allows different levels of control based on the relative importance of items.

Stock-Keeping Unit (SKU)

- Management decisions regarding inventories must ultimately be made at the level of an individual item or product
- The specific unit to be controlled will be called a stock-keeping unit
- A SKU will be defined as an item of stock that is completely specified as to functions, style, size, colour, and usually location.

ABC Analysis

- Classifies items based on the annual usage value (AUV)
- Identify a small percentage of items which account for most of the total inventory value Basic Principle 20/80 - Rule Pareto's Law – Vilfredo Pareto – Italian Economist "Few are vital' and 'many are trivial' AUV = Annual demand X Price.

Pareto's law applied to inventories

The relationship between the percentage of items and the percentage of AUV follows a pattern A – about 20 % of items account for about 80 % of the AUV B - about 30 % of items account for about 15 % of the AUV C - about 50 % of items account for about 5 % of the AUV Steps in Making an

ABC Analysis

- Determine the annual usage for each item
- Calculate the AUV of each item
- List the items according to their AUV (descending order)
- Calculate the cumulative AUV and the cumulative percentage of items
- Examine the annual usage distribution and group the items into A, B, C based on percentage of AUV

XYZ Analysis

Based on the value of inventory undertaken during the closing of annual accounts X – High value; Y – Medium value; Z – Low value.

HML Analysis

Items are classified according to the unit value as high, medium, and low. It is used to control the purchase value of items.

Movement Analysis (FSN Analysis)

Check stock rotations and identifies the obsolescence of items. This is particularly useful for spare parts Fast-, Slow- and Non-moving Analysis.

Criticality criteria (VED Analysis)

Vital, Essential and Desirable

- This is in the point view of operation particularly useful for spare parts control
- A vital equipment is one, which feeds a battery of equipment downstream

GOLF – Government-controlled, ordinarily available in the open market, Locally available and Foreign imported purchase

SDE – Scarce item or single source item, Difficult to obtain or Easy to obtain as it is an off the-shelf item.

SOS – seasonal and Off-seasonal

UNIT- II

ROLE OF WAREHOUSE IN DISTRIBUTION SYSTEM

1. Efficient storage

Materials get stored efficiently in warehouses as part of supply chain management. When materials are stored properly, getting them to customers becomes much faster and more efficient. Materials get stored in a warehouse in such a way that maintains their high quality. When looking for a facility for storage (warehouse), there are a few factors you need to consider to optimize the storage technique. Most of all, you must ensure that the warehouse you select suits your product needs. For instance, if you are supplying perishables, you might need to find temperature-controlled warehouses.

2. Strategic location

Where your warehouse lies can make or break your supply chain. You can select a warehouse along your supply route or near the port, where you will be shipping your items to or receiving them. You should choose a location that will help you move your items from one point to another promptly. The location of your warehouse can help you grow your business by attracting more customers and investors. An efficient supply chain management process can provide you with these benefits and many more. A strategic location can help improve inventory turns by optimizing the supply chain to meet the demand in the market.

3. Security

Your supply chain management is more secure with an efficient warehouse to prevent material spoilage and delays. Having a warehouse ensures your inventory is safe and in the best condition to enhance your supply chain. Suppliers can rely on your warehouses if your inventory is high quality and available when needed. Keeping the warehouse safe is also vital. It helps to avoid losses through theft or vandalism. You can also boost your warehouse security systems with security cameras, alarms, and yard patrols to secure your products.

4. Inventory accountability

The warehouse facilitates good inventory management and a high degree of accountability. Inventory control helps you access data in real-time for the supply chain to run smoothly. Boost your supply chain management with robust software like SAP Business One from Wisys. In a supply chain management environment, inventory control helps to match the supply with the demand. It helps boost your client experience since everything from the warehouse is up to standards.

5. Fulfillment of orders and distribution

Warehouses are an integral part of the distribution of products to suppliers and the fulfillment of orders. You can increase the efficiency of your supply chain by ensuring timely supplies. Inventory distribution, sorting, cross-docking, and other processes are made possible. You can also opt for third-party warehousing. It can help you expand on the rate you distribute and fulfill orders to your clients in the supply chain. SAP Business One can manage your warehouses and manage your supply chain.

6. Economic benefits

A warehouse optimizes the supply chain creating a wide range of economic benefits for the company. Warehouses store your items for later use when the demand is high. It ensures price stability and the mitigation of revenue losses. Seasonal demand for products enables warehouses to play a vital role in the supply chain. It helps to cut costs on outbound deliveries, transportation costs, and shipping costs. Warehousing also strikes a balance between demand and supply in the supply chain, increasing profits in a business.

7. Value-adding operations

Warehouses help to improve the utility value of goods in supply chain management. Warehousing makes sure that your products are at the right place at the right time. You can implement warehouse best practices to ensure that all operations of the company are managed properly. It adds considerable value to the overall performance of the company. Operations such as cross-docking, order consolidation, product mixing, order assembly, and many others all happen in one place (the warehouse), adding value to the entire supply management system. It also helps to improve quality

control in the supply chain. Warehousing ensures no process gets rushed unnecessarily, leading to errors and inaccuracies.

8. Enhance risk management

Warehousing enhances risk management by protecting your company against price fluctuations in the market. The warehouse can store goods when their demand from suppliers goes down in the supply chain. Also, most of the products in the warehouse are insured. Hence, you can receive compensation from your insurer in case of theft, fire, or damage. In turn, this helps keep you in business with your clients and the processes in the supply chain running efficiently.

Documents Used in Warehousing

1. Lorry Receipt (L/R)

It is an acknowledgement of goods given by the lorry owners (transport companies) to the persons who send goods. The consignor (Sender) sends this receipt to the buyer with the invoice and other documents. The buyer can take delivery of the goods only on production of this receipt at the destination. It is a document of title of goods and is a negotiable instrument by custom.

2. Railway Receipt (R/R)

When goods are sent through Railways, the railway authorities acknowledge receipt of goods which is called R/R. like L/R.It is also a document of title to goods and the Buyer has to produce this to the railway authorities while taking delivery of goods. Railway receipts are also negotiable instruments by custom.

3. Consignment Note

It is a form issued by railway companies to be signed up by all persons who intend to send goods by railways. It contains terms and conditions on which the railway company undertakes the carry the goods. This form is to be filled in and handed over to the Railways along with the goods.

4. Bill of Lading (B/L)

Bill of lading is also a receipt of goods issued by the master of the ship or the shipping companies in sea transportation. On the one hand, It is an acknowledgement of goods and on the other, a contract of carriage. Bill of

lading is prepared in three sets and three sets are sent to the consignee one by one. The consignee can use any one of them for getting delivery of articles from the ship. Bill of lading could be endorsed and negotiated by the third party.

5. Airway bill (AWB)

It is an bill of inventory or listing of cargo that is being transported by air. AWB is the abbreviation of Air Waybill, is the most important document issued by an airline either directly or through its authorized agent. It is a non-negotiable transport document**.** It covers the transport of cargo from airport to airport. By accepting a shipment an IATA cargo agent is acting on behalf of the airline whose Air Waybill is issued.

6. Dock Warrant or Warehouse Warrant

It is a document of title to goods issued by dock authorities certifying that the goods are held by them. To take delivery of the goods, this certificate has to be given back to the authorities. It is a transferable instrument and if properly assigned, even a third party can take delivery of the articles from the warehouse or dock.

7. Warehouse Keeper's Receipt

It is simply an acknowledgement of goods issued by a warehouse keeper to the owner of the goods. It is not a document of title to goods and, therefore, cannot be transferred at all.

8. Delivery Order

It is an order issued by the owner of goods to the warehouse authorities when delivery in small lots is required from the warehouse. Such orders should accompany the warehouse warrant in which the authorities will enter the details of goods party delivered. The delivery order is the document of title to goods, hence can be transferred.

The standard warehouse receiving process

Warehouse receiving is not simply a matter of purchasing inventory and having it delivered to your warehouse; rather, it involves several key steps that must be done right to ensure the right items and quantity are being delivered and stored correctly. Here is an overview of the standard process of receiving goods.

1. **Create proper documentation and then send your inventory**
   Before inventory is ordered and delivered, a business owner must complete pre-receiving tasks before sending inventory to a warehouse. During this stage, the business owner decides how much of each item will be shipped in how many containers, as well as determine packaging requirements for each item. If you partner with a third-party company (3PL), you will want to check their pre-receiving requirements as most of them have their own process for how to send inventory to their warehouse(s) and often steps you must complete before you send them your inventory.

2. **Receive and unload stock**
   If you manage a warehouse, the next step is to have warehouse receiving staff meet the shipper at a loading dock and unload the necessary cargo. Receiving staff should be standing by to discuss questions or concerns regarding the shipment with the delivery driver. Ideally, truck beds should be packed back-to-front in the reverse order of the delivery schedule so that warehouse workers can unload their inventory immediately without having to move another other cargo in the way.

3. **Count and confirm inventory**
   As the cargo is being unloaded, the warehouse staff checks the contents of each delivery, including the quantity, the integrity of seals, the product codes/SKUs, and the overall condition of the cargo to ensure that what's in the boxes matches what is listed on the WRO and is expected to arrive. Stock counting, inspection, and general warehouse operations can be time-consuming. To avoid hours at the loading dock, some merchants require warehouse staff to count boxes or pallets, rather than individual items, or choose to perform periodic random inspections.

4. **Store and file product**
   Once all inventories is unloaded and inspected, the final step in the warehouse receiving process is organizing and storing new inventory in the warehouse. This step looks different for each business, depending on the type of warehouse, the quantity and size of their items, and whether a business relies on a 3PL partner for inventory storage. Depending on the size and quantity of products, inventory can be stored either on a palette, a shelf, or a bin.

Unloading

While there are many risks of loading and unloading freight, most of them can be minimized with clear safety guidelines and the implementation of warehouse-wide protocols. Let's look at some actions you can take to increase warehouse safety.

1. **Utilize Modern Restraints**

   Restraints are an easy and cost-effective way to keep your employees safe while loading and unloading freight. They help reduce "truck creep," securing the truck's rear impact guard once it's in the loading dock. Restraints are necessary as they lock vehicles in place during the unloading and loading process. Unfortunately, many companies still use outdated or less effective restraint systems. For example, chocks introduce risk during the attachment process and are more prone to human error. That's why it's best to implement automatic restraints linked to a master control panel. Thanks to a robust centralized control system, there's no risk of error because it automatically prevents any action from occurring until the vehicle is secured.

2. **Add Barrier Gates & Dock Levelers**

   Some of the most common injuries when unloading and loading freight involve people falling or tripping due to gaps and elevated ledges in the warehouse. To avoid these accidents, it's crucial that you strategically plan for the most vulnerable areas. You can minimize risk by installing barrier gates that can be opened or closed as needed and dock levelers that close the gap between loading docks and trailers. This protects your workers, especially if your warehouse has specific areas that operate heavy machinery.

3. **Implement a Centralized Management System**

   Harness the power of technology to keep your teams and cargo safe. Automation can be one of the most powerful solutions for reducing the likelihood of human error, which minimizes the risks of safety issues. You can develop an automated process for planning and executing activities safely and more effectively by implementing a centralized warehouse management system. This not only increases unloading and loading safety in your warehouse, but you can also use it to collect, track and analyze data.

A centralized management system can help you streamline all your processes.

4. **Don't Forget About Lighting**
   Another aspect of loading and unloading trucks safely is providing adequate lighting throughout your warehouse. This is especially true for loading and unloading areas, which must always be well-lit. However, while warehouse lighting is crucial to employee safety, it also creates clear and effective communication channels.

5. **Train Employees**
   These security measures will not be effective if your employees aren't trained to follow them. Therefore, any unloading and loading safety practices must begin with you thoroughly training every employee. Note: you shouldn't teach them once and then forget about it. You should regularly revisit training to ensure they know how to handle cargo safely and use various equipment to keep themselves and others safe.

What Is Palletization

Palletization covers three disciplines in the pallet distribution world and is often referred to in a few different areas in day-to-day life at Cross Country Carriers. The first discipline seems the most obvious; palletisation refers to the act of placing objects, products or materials on pallets. In turn, they are used for handling or moving. The next area it covers is the performance of material handling with the aid of pallets. Lastly, the slightly more vague definition is where palletization refers to providing a user with the ability to handle pallets.

1. **Increasingly Strong Pallets**
   Pallets are made of wood, plastic or metal and are a much stronger alternative to material containers like cardboard boxes or plastic wrappers. The structure of a pallet is far more sturdy, allowing a larger number of heavier objects to be transported without the risk of breakage. Furthermore, as a result of the pallet's strength, there is an option to reuse them multiple times. It's important to make sure that you keep a check on your pallets though, as overuse often leads to pallets being broken. Repairs and replacements aren't too costly, but the potential damage it could cause to your business might be!

2. Pallets Prevent Product Damage

Thankfully, a well-maintained pallet will allow you to rest easy knowing that cargo will not be damaged at all. By storing and transporting your products on pallets, they are able to be kept off the ground which reduces the risk of damage from water, dirt and debris. If done correctly, Palletization also provides drainage and circulation for your products. If you are carrying perishable items, they will stay safe and fresh. Speak to us if you feel you need some advice with palletizing your goods, we have a wealth of experience in the pallet distribution industry.

3. Faster Pallet Distribution

Palletization allows pallets to be moved a lot quicker compared to manual handling; this in itself presents a number of benefits. There are reduced labour requirements, faster turnaround times and an opportunity for optimum temperatures for perishable products.

4. Pallets are Cost Effective

Outside of the speed and strength benefits, pallets are also very cost effective. The pallets themselves are lightweight and take up a small amount of space. They are easily moved and efficiently stored in warehouses and consistency in size, weight and shape allows us to stack pallets high. Furthermore, less floor space is required and workers are able to carry them when necessary.

5. Material Handling

Palletization in material handling is easier as pallet transportation does not require specialist equipment. A forklift or pallet jack is ideal for lifting and stacking pallets. Using this equipment will help prevent products being damaged at any stage.

Stock update

Warehousing is complex and there are many ways things can go wrong. All too often, supplies arrive with poor labelling, products are put away incorrectly, operations are disrupted by manual cycle counts, and carriers wait idly for shipments that aren't ready. However, the focus for warehouse operations has traditionally been on efficiencies and error reduction in order picking, which overlooks the potential to make improvements throughout the process, from

receiving through to shipping. As such, many current systems don't meet the challenges faced by a modern distributive business, which requires:

- **Control of inventory**, end-to-end, and across multiple locations or branches. This enables you to manage stock levels and ensure delivery to customers, whilst also keeping control of margins.
- **Tracking of items** from receiving from suppliers, through sales and order processing, picking, delivery, returns and accounting. This will reduce manual processing, and the associated risk of error and enable you to keep customers accurately informed about their orders.
- **Management of the space** of the warehouse, to ensure stock can be put away, found and picked most efficiently, and to maximize operatives' time.
- **Visibility of management information** to understand where problems are arising, implement improvement initiatives and track the success of changes. This will enable you to progressively and continually improve your processes and to get more from your existing resources and your investments in warehouse technology.

Location and zone management

1. **Dry zone**
   In this zone, you can store products required to keep away from moisture. It is the most common zone in a warehouse. In this zone, the temperature will be maintained between 50 to 70 degrees Fahrenheit.

2. **Refrigerated zone**
   It is necessary to be there in the warehouse zone storage area. In this zone, you can keep the products required to be stored at low temperatures, such as food products, vaccines, etc. The temperature of this zone will vary from zero to 38-degree Fahrenheit.

3. **Flammable zone**
   Some manufacturing companies require chemicals for their manufacturing process. An approved storage cabinet should store these chemicals.

4. **Corrosive materials**
   In this zone, you can store acids. This zone should be located separately where the corrosive materials like acids will not contact other items.

5. **Gas cylinder storage**
   Gas cylinders must be stored separately in the warehouse. Therefore, it is necessary to follow safety measures like carts and safety chains while transporting the gas cylinders in the warehouse.

6. **Oversize storage**
   Some products need more space because they will not fit on regular shelves. For that products, this zone is valuable.

7. **Security cage**
   In this zone, you can store valuable items such as brand-name pharmaceuticals.

UNIT- III

ROLE OF INVENTORY SYSTEMS

Modern inventory systems help your business maintain profitability. Without a system, you could be wasting money on inventory without being aware of it. You may be buying too much or not buying enough. You could be spending money counting and trying to value your inventory. You may also be losing money because you don't know where your inventory is.

1. Tracking

The primary role of an inventory system is to track your products and supplies. An effective system keeps records of when you purchased inventory, when you sold it and how much you have on hand. It also tells you the location of your inventory. This can be particularly important if you use your inventory in various departments. For example, a supply of rubber may pass through production, go to shipping and end up in a warehouse in a remote location. An effective system lets you follow the way inventory moves through your company.

2. Preventing Out-of-Stock Conditions

Your inventory system can alert you when you are running low on an item. This allows you to order it in a timely manner so you don't have to turn customers away if you run out. In addition, you won't have to order as much back stock to keep on your shelves because you can count on your inventory control system to alert you when levels drop to a critical point.

3. Avoiding Duplication

You can easily acquire too much inventory by placing duplicate orders. This happens when an item is not on your storage shelf where it should be; if you assume you're out of stock, you place another order. An inventory control system avoids such duplication by letting you know that you already have the item in stock in a different location.

4. Valuing Inventory

An inventory control system can tell you the various prices you pay for inventory throughout the year. Even if you bought the same item several times at different prices, an inventory control system can track those prices so you know your average price. This can help you set selling prices and calculate your profit margin.

5. Counting

With an inventory control system, you do not have to pay employees to physically count items. You will know how much you have at all times based on the data in your system. This can save a great deal of money on payroll for inventory personnel.

Importance of Inventory Management

There are multiple reasons underlying the importance of inventory management. Some of these are listed below:

- Insightful details on inventory - An inventory management system gives you a realistic status of your entire business product cycle. These details play an important role in scaling your business operations, improving the operations cycle and making timely deliveries.

- In the case of storage across a couple of warehouses, you can centralise your data. With features like barcode scanning, you will be able to monitor all the operations easily, and this will help you plan your business more efficiently.

- Timely fulfillment of orders - An inventory management system aids in the speedy fulfillment of numerous customer orders. This ensures your business a steady flow of repeat orders as well as attracts new clients because of the good publicity spread by happy customers.

- Time-effective – Inventory systems with their organized mechanisms manage your inventory accurately. This allows you the freedom of more time to focus on other aspects of the business, e.g., expansion and setting up franchisees.

- Helps you to maintain a healthy cash flow – Small-scale businesses cannot afford to stock large volumes of inventory, and they have limited financial constraints. An inventory management system helps you to control your stock storage. It helps you to place orders of fast-moving and in-demand goods in a timely manner. You invest your revenue resources in accordance with such details. This prevents you from investing in large volumes of inventory. The additional money can be used to enhance other key aspects of your business.

- Increased profits – A business without an inventory management monitoring system is vulnerable to thefts. If you implement an inventory monitoring system, it protects your inventory.

- Better sales strategies – With details on real-time data in your storage facilities or warehouses, you can improve your sales strategies to fulfill client requirements more effectively.

- Competitive advantage – Proper management of your inventory is a competitive advantage that enhances the performance of your business.

- Seasonal management of inventory – Some products are seasonal. An inventory management system will help you manage seasonal inventory without experiencing any wastages. It facilitates the placement of such products at the right time in accordance with the seasonal demand.

- Optimal efficiency of resources – Real-time data helps you understand what stocks need to be avoided in their entirety. It also enables you to understand the merchandise which contributes the most towards profits. You can make appropriate investments in such stocks. Your additional finance reserves can be used in the diversification of your business.

Inventory replenishment process

The inventory replenishment process is the strategy a retailer uses to identify which products to replenish order & pick inventory from storage, and transport the product to location for sale.

1. **Periodic Strategy**
   Inventory levels are assessed and replenished at set intervals of time (E.g. bi-weekly, monthly, or quarterly). Retailers manually measure inventory levels and the cost of goods sold (COGS) to determine what needs to be replenished.

2. **Reorder Point Strategy**
   An automated approach triggered by inventory levels. Retailers set stock and replenishment parameters that indicate when stock needs to be reordered. A maximum stock level is set to limit overstocks, as well as determine the amount of inventory to be ordered. Once a set minimum stock level is reached, the replenish system is triggered and an automated order is placed.

3. **Top-off Strategy**
   Stock is topped off during downtime or slow periods of selling to minimize the chance of stock-outs when demand spikes. This strategy is especially useful for retailers with high-demand SKUs that have short picking windows.

4. **Demand Strategy**
   Demand forecasting is used to proactively identify where inventory will need to be replenished and in what quantities in order to meet sales demand. Unified replenishment solutions account for inventory across all channels and locations enabling inventory rebalancing and allocation.

Forecasting Techniques

1. **Inventory Forecasting:**
   If you analyzed the historical sales data of every product in your warehouse, you'd find that the demand for different items varies considerably. Some will have consistently high demand over time, for others, there could be sporadic or low demand.

2. **Inventory Demand Trends**
   The demand for your inventory items will ebb and flow as fashions change, new technologies replace old, and social, economic, and legal factors influence demand. Items will also follow demand trends as they move

through the product cycle. For example, in the growth phase, the trend in demand will be upwards, while in the decline phase, the trend will reverse. Make sure you look out for trends in your historical demand data and adjust your inventory forecasts accordingly. There's no point creating a forecast based solely on your base demand if items are following a specific trend.

3. Forecasting Demand for Seasonal Items

Almost every manufacturer, distributor, or retailer can expect to see seasonal demand fluctuations for some of their product lines. Seasonal weather patterns, school holidays, and annual traditions all have a seasonal influence on demand.Understanding how these seasonal factors affect your customers' purchasing habits will help you take advantage of peaks in demand and plan for the troughs. The best practice is to keep seasonal demand factors separate from your base demand calculations. This keeps the data clean and easier to use for forecasting going forward.

4. Qualitative Inputs

While historical data (quantitative demand forecasting) provides a great basis for achieving demand forecasting accuracy, sometimes you'll also need to consider more qualitative factors. Qualitative demand forecasting includes accounting for future events and external market factors, such as sales promotions and competitor activity. Make sure you input any sales and marketing insights you have into your forecasts to make them as accurate as possible.

5. Inventory Demand Forecasting Outliers

Unusual demand outliers can be the result of known actions (sales promotions, large one-time orders, employee strikes, etc.) or unpredictable events (a competitor going out of business, natural disasters, etc.). Take the time to analyze your inventory forecasting data to detect outliers, as they can significantly skew the accuracy of your forecasts. Any demand data – high or low – outside of the reasonable standard deviation of average demand needs to be identified.

6. Understand Demand Forecasting Accuracy

Your demand forecasts are very unlikely to be 100% accurate. So, if you can calculate the level of error in your previous demand forecasts, you can factor this into future forecasts. If you can determine how uncertain a forecast is

for a given business period you can make the necessary adjustments to your inventory management rules, such as increasing safety stock levels to cover uncertain periods of demand.

7. **Demand Forecasting Periods and Reviews**
   The time period you choose for your demand forecasting has a direct impact on the accuracy of your forecast. For example, a forecast looking at your inventory's demand over the next two weeks is much more likely to be accurate than a forecast that looks 12 months out.

8. **Consider Demand Forecasting Software**
   Accurate demand forecasting is not a simple task, especially if you want to track each SKU and you have a large product portfolio. Inventory forecasting also requires an accurate picture of the stock levels in your warehouse and your sales across each channel.

Economic order quantity

Economic order quantity (EOQ) is a calculation companies perform that represents their ideal order size, allowing them to meet demand without overspending. Inventory managers calculate EOQ to minimize holding costs and excess inventory.

Benefits of Economic Order Quantity (EOQ)

The main benefit of using EOQ is improved profitability. Here's a list of benefits that all add up to savings and improvements for your business:

1. **Improved Order Fulfillment**
   When you need a certain item or something for a customer order, optimal EOQ ensures the product is on hand, allowing you to get the order out on time and keep the customer happy. This should improve the customer experience and may lead to increased sales.

2. **Less Over ordering**
   An accurate forecast of what you need and when will help you avoid over ordering and tying up too much cash in inventory.

3. **Less Waste**
   More optimized order schedules should cut down on obsolete inventory, particularly for businesses that hold perishable inventories that can result in dead stock.

4. **Lower Storage Costs**
   When your ordering matches your demand, you should have less products to store. This can lower real estate, utility, security, insurance and other related costs.

5. **Quantity Discounts**
   Planning and timing your orders well allows you to take advantage of the best bulk order or quantity discounts offered by your vendors.

Challenges of Economic Order Quantity (EOQ)

While many businesses want to use EOQ to determine order sizes, it isn't always easy to achieve. When determining EOQ, you may run into these challenges:

1. **Poor Data**
   One of the biggest challenges of determining EOQ is access to accurate and reliable data. Manual or spreadsheet-driven systems may provide low-quality or outdated information, which can lead to inaccurate calculations.

2. **Outdated Systems**
   Old and outdated systems may have incomplete data and lead to missing out on potential savings. An inventory management system or cloud-based ERP can solve this problem.

3. **Business Growth**
   The EOQ formula is ideal for businesses with consistent inventory needs. With a fast-growing business, relying on EOQ can lead to inventory shortages.

4. **Inventory Shortages**
   If you're just starting to use this method, it often generates smaller orders. If you are too conservative with your calculations, you could wind up under-ordering.

5. **Seasonal Needs**
   Seasonality can make EOQ more challenging, but not impossible. This is because there could be major changes in customer demand throughout the year.

Safety stock

Safety stock helps eliminate the hassle of running out of stock. If you hold sufficient safety stock, you needn't rely on your suppliers to deliver quickly or turn away customers because of depleted inventory levels. Safety stock covers you until your next batch of ordered stock arrives. Let's see how safety stock is important for your business:

1. **Protection against demand spikes**
   Safety stock protects you against the sudden demand surges and inaccurate market forecasts that can happen during a busy or festive season. It serves as a cushion when the products you've ordered take longer to reach your warehouse than you expected. It ensures that your company doesn't run out of popular items and helps you keep fulfilling orders consistently.
2. **Buffer stock for longer lead times**
   Even if your supplier has been consistent with delivering products on time and you've never faced a supply lag yet, this might not always be the case. Unexpected delays in production or transportation, such as a bottleneck at your supplier's end or a weather-related shipping delay, can cause your products to reach you later than expected. During these situations, safety stock acts as your defense against a possible stock out scenario and helps you fulfill your orders until your ordered stock is delivered to you.

3. **Prevention against price fluctuations**
   Unpredicted market fluctuations can cause the cost of your goods to increase suddenly. This can be due to a sudden scarcity of raw materials, an increase in price of raw materials, unexpected demand surges in the market, new competitors, or new government policies. If you've got enough safety stock

during these unpredictable situations, it can help you avoid the costs of buying stock at higher prices without sacrificing sales.

How to calculate safety stock

To get the benefits of keeping safety stock, you need to know how much safety stock to keep. This is because too much safety stock can lead to higher holding costs, and too little safety stock results in loss of sales. Using a formula will help you calculate the optimal amount of safety stock for your business. Each method of calculating safety stock uses slightly different details, but they all require you to know your lead time, which is the time between the initiation of an order and the completion of the delivery process**.**

1. **Fixed safety stock**

   Fixed safety stock is a method used by production planners. They determine the amount of safety stock to keep from the maximum daily usage for over a period of time, but without using a particular formula. The value for fixed safety stock generally remains unchanged unless the production planner decides to change it. Fixed safety stock levels can even be set to zero for items that you want to phase out. However, if there is a sudden demand surge for an item with very little safety stock, you might not be able to fulfill the orders.

2. **Time-based calculation**

   In this method, safety stock levels are calculated over a particular time period, based on the future forecast for the product. This method includes a combination of actual demand from sales orders, and forecasted demand based on statistical methods. This method cannot predict business uncertainties, so using it involves a risk that you might end up carrying too much unwanted stock if your products are moving slower than forecasted.

3. **The general formula**

   This is the most simple and commonly used method to calculate safety stock. It calculates the average safety stock the company needs to hold during a stockout scenario, but it doesn’t consider the seasonal fluctuations of demand.

4. **Heizer & Render's formula**
   Heizer & Render's formula is ideal when there are significant variations in supply on your vendor's end. It uses the standard deviation of the lead time distribution, giving you a more accurate picture of your lead time and how frequently you deal with very late shipments. However, it doesn't take demand changes into account.

5. **Greasley's formula**
   Greasley's formula takes both lead time and demand fluctuations into account, which provides a more accurate way of calculating safety stock. But it doesn't take into account stock which is still in production and not yet ready for sale. Safety stock acts as a defense against unexpected circumstances. Calculating safety stock accurately is crucial to avoid losing sales due to stock outs or supply chain interruptions. Like many other kinds of business decisions, there is no one-size-fits-all formula that will work for all businesses, so choose the method that works the best for your business.

Execution

A warehouse execution system is software that manages, optimizes and directs the physical work processes (picking, receiving, replenishment, etc.) in a warehouse or distribution center. A WES typically integrates with a warehouse management system (WMS), enterprise resource planning system (ERP) or other inventory management software.

Warehouse execution systems have been around in various forms since the early 2000s. They provide DCs with flexible and efficient material handling processes – both automated and manual. While WMS systems typically include system-directed picking, replenishment and other functions, WES systems add sophisticated process optimization capabilities. WES vastly improve the productivity, efficiency and throughput of core DC activities. WES systems take two main forms – automated WES and manual WES.

Two Types of Warehouse Execution Systems

1. **Automated Warehouse Execution Systems**
   Many of today's WES products evolved from an existing warehouse control system (WCS). WCS software controls conveyors, sorters and other warehouse automation that move totes, cases and pallets within a facility. In

effect, automated warehouse execution systems combine a WCS with a layer of work planning, release and management capabilities. They coordinate and synchronize the handling and movement of products via automation.

Some WES products may also manage pick-to-light or put-to-light systems, but they typically do not direct the work performed by people. Instead, most WES systems defer to a WMS or other system to direct manual picking and other processes.

2. Manual Warehouse Execution Systems

Manual warehouse execution systems are similar to automated warehouse execution systems, but offer more intelligence, orchestration and optimization across end-to-end warehouse processes – picking, receiving, put away, sortation, loading, audit, replenishment, cycle count, slotting, labor planning, etc.

These solutions typically use order, inventory, and task information from a DC's inventory planning system (WMS or other) and reuse and extend existing WCS (and automated WES) systems. And beyond just optimizing people, manual warehouse execution systems help DCs orchestrate and optimize resources – people, robots, inventory – across IT and automation systems.

Inventory Turnover Ratio Analysis Definition

Inventory turnover ratio, defined as how many times the entire inventory of a company has been sold during an accounting period, is a major factor to success in any business that holds inventory. It shows how well a company manages its inventory levels and how frequently a company replenishes its inventory. In general, a higher inventory turnover is better because inventories are the least liquid form of asset. A Flash Report is a useful tool in measuring and managing inventory turns.

Inventory Turnover Ratio Analysis Explanation

Inventory turnover ratio explanations occur very simply through an illustration of high and low turnover ratios. Despite this, many businesses do not survive due to issues with inventory. A low inventory turnover ratio shows that a company may be overstocking or deficiencies in the product line or marketing effort. It is a sign of ineffective inventory management because inventory usually has a zero rate of return and high storage cost. Higher inventory turnover ratios are considered a positive indicator of effective

inventory management. However, a higher inventory turnover ratio does not always mean better performance. It sometimes may indicate inadequate inventory level, which may result in decrease in sales.

Profit Margin

Profit margin is a mathematical expression of profit — it's the amount of money your business takes in, expressed as a percentage that takes into account your business costs. For our purposes, there are two types of margins to consider: gross profit margin and net profit margin.

Gross profit margin: The difference between the sales price and the total cost of production, including labor cost and material cost.

Net profit margin: The difference between total business revenue and total business expenses.

While net profit margin is a useful KPI for the entire business, gross profit margin is the more useful KPI for inventory management. That said, your net profit margin reflects the overall success of your strategy. If you're calculating the effectiveness of inventory forecasting as well your ROI for marketing spend, your net profit margin tells you what you need to know. One way to maximize your net profit margin is to choose a free inventory management tool that allows you to improve efficiency without subtracting from your bottom line.

Profit margin formula

For your inventory management needs, the gross profit margin is the most applicable profit measurement form. The gross profit margin formula is:

Net sales – total cost of inventory / net sales = gross profit margin.

UNIT- IV

MATERIAL REQUIREMENT PLANNING COST

MRP helps businesses and manufacturers define what is needed, how much is needed, and when materials are needed and works backward from a production plan for finished goods. MRP converts a plan into a list of requirements for the subassemblies, parts, and raw materials needed to produce a final product within the established schedule. MRP helps manufacturers get a grasp of inventory requirements while balancing both supply and demand.

Using MRP, managers can determine their need for labor and supplies and improve their production efficiency by inputting data into the MRP scheme such as:

Inventory Status File (ISF): Materials available that are in stock and materials on order from suppliers.

Bills of materials (BOM): Details of materials and components required to make each product.

Planning data: Restraints and directions like routing, labor and machine standards, quality and testing standards, and lot sizing techniques.

The MRP process:

- Estimates demand and required materials. After determining customer demand and utilizing the bill of materials, MRP breaks down demand into specific raw materials and components.
- Allocates Inventory of materials. MRP allocates inventory into the exact areas as needed.
- Schedules Production. Time and labor requirements are calculated to complete manufacturing and a timeline is created.
- Monitors the process. MRP automatically alerts managers of any delays and even suggests contingency plans to meet build deadlines.

The Material Requirements Planning

The Material Requirements Planning or MRP is a subset of the Inventory Control System. It determines the exact quantity of dependent demand items required for production as specified in the Master Production Schedule (MPS).

1. **Estimation of Net Requirements to meet demand**
   The process begins with identifying the number of units required to meet the demand. Thereby disintegrating the end product into multiple individual items. In addition, acquire the list of required materials from the BOM. And converting the gross requirements specified in MPS into net requirements.

2. **Evaluate existing Inventory against demand**
   After assessing the net requirement check, the existing Inventory against the demand received. For this purpose, you can use the following formula.

3. **Scheduling Production**
   The next step is to schedule the production to produce the required **quantity**. It includes the allotment of the number of workers needed to carry out production. Also, it determines the time and date for the delivery of the demanded products.MRP involves two-way scheduling, i.e. forward or Backward Scheduling.
   - **Backwards scheduling:**
     It begins with ascertaining the on-shelf date of the product. And the scheduling takes place in the backward direction.
   - **Forward Scheduling:**
     In this, scheduling is based on the starting date of the manufacturing process.

4. **Monitoring and Review**
   The last step is keeping track of the complete process. In addition, taking necessary corrective measures as and when required.

Inventory accounting

Inventory accounting is all about how a business would show the stock it holds in its financial records – balance sheets, profit & loss (P&L) reports, etc. This is typically more complex than it sounds as inventory is often a 'live figure' that's constantly changing as sales are made and more stock purchased.
In retail, this can cover three types of inventory or production phases:

a. Raw materials.
b. In-progress items.
c. Finished products ready for sale.

Your on-hand, unsold inventory needs to be included as an asset in end-of-year financial records. Meaning the crux of the matter in all this is to correctly track both the cost of any inventory sold and place an accurate value on the unsold inventory being held at the end of each accounting period. Any increase or decrease in the value of goods affects your inventory value figure. This then, in turn, affects the value of your overall business.

Inventory accounting key terms

There are two key terms retailers need to be aware of when it comes to inventory accounting:

Cost of goods sold (COGS). The direct costs of producing any goods sold by a company.

Ending inventory (EI). The value of any unsold, on-hand inventory at the end of an accounting period.

1. Cost of goods sold (COGS)

Cost of goods sold (COGS) is a core element of measuring a retail business's profitability and inventory value. As the name suggests, COGS refer to the amount it cost a business to produce the products it sold, including everything that went into it – materials, labor, tools used, etc. But (crucially) without factoring in costs not directly tied to the production process – like shipping, advertising and sales force costs, etc. As a result, COGS help you determine the amount of gross profit made in one or more sales.

2. Ending inventory (EI)

It's highly likely that a business will not sell the entirety of its inventory at the end of each accounting period. Meaning any on-hand, unsold stock becomes an asset that must be valued and included in financial statements.

Purpose of Inventory management system

The main purpose of inventory management is to help businesses easily and efficiently manage the ordering, stocking, storing, and using of inventory. By effectively managing your inventory, you'll always know what items are in stock, how many of them there are, and where they are located.

Plus, practicing strong inventory management allows you to understand how you use your inventory–and how demand changes for it–over time. You can zero in on exactly what you need, what's not so important, and what's just a waste of money. That's using inventory management to practice inventory control. By the way, inventory control is the balancing act of always having enough stock to meet demand, while spending as little as possible on ordering and carrying inventory.

Inventory management must tie together the following objectives, to ensure that there is continuity between functions:

- Company's Strategic Goals
- Sales Forecasting
- Sales & Operations Planning
- Production & Materials Requirement Planning.

Inventory Management must be designed to meet the dictates of market place and support the company's Strategic Plan. The many changes in the market demand, new opportunities due to worldwide marketing, global sourcing of materials and new manufacturing technology means many companies need to change their Inventory Management approach and change the process for Inventory Control.

Inventory Management system provides information to efficiently manage the flow of materials, effectively utilize people and equipment, coordinate internal activities and communicate with customers. Inventory Management does not make decisions or manage operations; they provide the information to

managers who make more accurate and timely decisions to manage their operations.

Types of goods

1. **Private goods:**
   Private goods are excludable and rival, meaning consumers need to pay for them and there's a limited supply. When an individual buys an item, that particular item is no longer available to others. Most consumer goods fall into this category. If you work for a company that provides private goods, it's important to understand how to manage supply and pricing strategies effectively to ensure company profitability and customer satisfaction.

2. **Common goods:**
   Common goods are non-excludable and rival, meaning they are free but limited in supply. Governments often manage these natural resources for consumers. For example, a government body could create fishing quotas to prevent overfishing. If you work in an industry involved in the extraction of raw materials, it's important to understand how to work with relevant legislation and manage resources to ensure long-term sustainability.

3. **Club goods:**
   Club goods are excludable and non-rival, meaning consumers pay for them and they are unlimited in supply. These goods could have a flat subscription fee, or companies could have tiered services or memberships.

4. **Public goods:**
   Public goods are non-excludable and non-rival, meaning they are free for everyone and unlimited in supply. The public sector typically manages public goods.

Finished Goods Inventory

Finished goods inventory is the third and final classification of inventory that is used for accounting purposes by manufacturing companies, the items that are sold to the customer. Manufactured products begin as raw materials and then move into the work-in-progress (WIP) stage as they are being produced. End products ready for distribution and sales constitute the finished goods inventory.

1. **Raw materials:**
   These are the objects needed to create the product. For OMI, that means wood, oarlocks and carbon-fiber plastic to make the shell of the boat, to name a few. For each product, it's important for OMI to keep the correct level of stock of raw materials inventory on hand to feed the production process and generate the right quantity of finished goods.

2. **Work in progress**:
   Items in the various stages of production are considered WIP inventory. They're not yet ready for distribution or retail. The outer shell of a rowboat without the seating inside it or the oarlocks in place is, obviously, a WIP. WIP inventory value includes materials, labor and direct overhead costs.

3. **Finished goods**:
   The fully manufactured and painted rowboat, outfitted with seating and oarlocks, represents the finished goods in this example. That boat is now ready to be shipped to its distribution destination.

Calculating finished goods inventory can enhance customer experience by preventing products from going out of stock. There are several reasons why calculating finished goods inventory is important for businesses.

1. **Gross Income**
   Inventory is one asset that needs to be included in financial documents like income statements, account statements, etc. Calculating finished goods inventory helps identify the gross income and eases the process of planning budgets.

2. **Finances**
   Calculating finished goods inventory saves businesses from wasting capital on unnecessary raw materials and finished products.

3. **Inventory Management**
   Calculation of finished goods inventory enhances the inventory management system by identifying labour and management costs.

Types of stocks

1. **Stocks on the basis of ownership rules:**
   This is the most basic parameter for classifying stocks. In this case, the issuing company decides whether it will issue common, preferred or hybrid stocks.

2. **Preferred & common stocks:**
   The key difference between common and preferred stocks is in the promised dividend payments. Preferred stocks promise investors that a fixed amount will be paid as dividends every year. A common stock does not come with this promise. For this reason, the price of a preferred stock is not as volatile as that of a common stock. Another key difference between a common stock and a preferred stock is that the latter enjoy greater priority when the company is distributing surplus money.

3. **Hybrid stocks:**
   Some companies also issue hybrid stocks. These are often preferred shares that come with an option to be converted into a fixed number of common stocks at a specified time. These kinds of stocks are called 'convertible preferred shares'. Since these are hybrid stocks, they may or may not have voting rights like common stocks.

4. **Stocks with embedded-derivative options:**
   Some stocks come with an embedded derivative option. This means it could be 'callable' or 'potable'. A 'callable' stock is one which has the option to be bought back by the company at a certain price or time.

Inventory Tracking

Inventory tracking is the systems and methods a company uses to monitor how raw materials or finished goods move through the supply chain. Fundamental to generating revenue, the goal is to have the right amount of stock to meet customer demand.

Manual Tracking:

Those who aren't ready to invest in an inventory tracking system often track their inventory using pen and paper. With this method, you'll need to update

a master data sheet that categorizes all inventory either at regular intervals or whenever there is a transaction.

Card System:

Kanban, also known as the visual sign or card method, is a just-in-time (JIT) system designed to limit excess stock. Rather than try to predict demand, Kanban is a pull system, where cards are used to track stock, production and inventory and signal when more is needed. The system was developed by automakers in Japan, and the name Kanban comes from the Japanese word for sign.

Spreadsheets:

Spreadsheets organize and categorize massive amounts of data. But manually entering and managing the data is prone to mistakes and is not efficient or scalable.

Accounting Systems:

Integrating accounting and inventory management systems gives you a powerful tool for inventory tracking. It not only shows detailed views of your inventory and stock, but how different inventory decisions affect your company's finances.

Inventory Management Systems:

Inventory management systems track stock and inventory, forecast demand and generate reports. They also have customer support and training options. They're most useful when integrated with accounting and payment processing.

Open Source Software:

Some small businesses turn to open source software for inventory management. These platforms usually provide interfaces, basic dashboards and some tracking features. But they often lack many of the advanced features, such as integrating with the rest of your systems, creating what's known as a data silo. Another drawback is the lack of customer service and training.

Cloud-Based Software:

Most solutions are cloud-based and mobile-friendly. They also integrate with other software. Businesses that need to scale inventory management for

multiple users tracking stock across locations benefit from the flexibility and cost-savings that cloud solutions provide.

In-House Solution:

Organizations with enough internal resources to plan, design, develop and deploy their on-premises inventory management systems may decide to build custom inventory tracking applications. The advantage is a system tailored to match specific business needs with custom features and in-house tech support to help troubleshoot system issues.

Third-Party Providers:

Outsourcing inventory management and logistics to a third-party logistics (3PLs) provider frees up space, time and resources for retailers and ecommerce businesses that are 100% online. These 3PL companies receive, store, move and track inventory for their customers. With this strategy, you avoid the expense of physical warehouses and use drop shipping to manage inventory but add the potential problems of added costs, loss of control, systems that aren't synced and communication issues.

UNIT- V

WORK IN PROCESS (WIP) INVENTORY

Work in process inventory encompasses all inventory types in the intermediate stage between raw materials inventory and final products. If raw material is combined with direct labor but is not ready to be sold, it counts as WIP inventory. On any merchant's balance sheet, the inventory line item is made up of three types of inventory:

1. **Raw Materials**: The materials used to assemble your product. For example, if you sell baking mixes, your raw materials would be the flour, salt, baking powder, etc. in the mix, as well as packaging materials.

2. **WIP Inventory:** These are products that are currently at some phase of the manufacturing process. They are in an unfinished state and therefore unable to be sold. Once a raw material meets human labor, it is considered a work in process.

3. **Finished Goods:** These are your final assembled products that are ready to be sold. Once an item has been sold it's referred to as merchandise and associated costs are moved to Cost of Goods Sold (COGS) in the accounting ledger.

So for the purposes of accounting, WIP inventory is the total value of any unfinished goods, and although they can't be sold, these goods are counted as an asset on a balance sheet. It's important to include WIP inventory as an asset when calculating the value of your business for finding investors or securing financing. On the accounting side, calculating WIP inventory is also important for understanding the true value of your inventory for tax purposes.

Often, parts warehouses and inventories do not receive the attention needed to ensure that they operate efficiently and remain accurate. Some reasons we see this are that management perceives that parts departments don't generate income for the company and they assume that parts should be easy to manage.

This mindset, along with failing to manage your parts systematically and failing to utilize warehouse inventory best practices, can be problematic. If the focus is ever turned to fixing these problems, you may quickly realize that it will be difficult and potentially painful.

Fortunately, there are things that can be done that will help ensure that problems don't arise, and your parts warehouse will run smoothly. An accurate parts inventory system allows the parts department to be more proactive and responsive to the plant. Companies can save significant dollars by not having to expedite a part when in fact it is already on-site in the warehouse. Here are seven spare parts inventory management best practices for managing parts inventory more effectively:

Spare parts inventories

1. **Systematically identify all parts:**
   When equipment is going to be down for a major overhaul, there may be several items that are purchased for a one-time use. Because of this, some of these parts may not be a stocked item and not created as a part record in the inventory control system. Once the machinery overhaul is completed, there may be unused parts which have future use and should be inventoried. Other equipment in the plant may be able to use these unused parts. Rather than maintenance storing these parts in a box, work bench or cabinet somewhere, the items should be added to the inventory control system and placed into parts inventory.

2. **Utilize and Manage the Bill of Materials (BOM):**
   BOMs will make ordering parts and placing work orders much simpler. Additionally, make sure that your BOMs are kept up to date. The worst thing that can happen is to start creating inventory inaccuracies because a part was not added, changed, or removed from a BOM. Having accurate BOMs will also assist you with scheduled preventive maintenance (PM) that is needed on a given piece of equipment. In some systems, the PM schedule will generate a work order with the scheduled date of the PM.

3. **Streamline the work order process:**
   One way to improve spare part efficiency is to have a strong but simple work order process that can be followed by everyone. Work orders need to be created for all parts issuance so that inventory remains accurate. Develop a

work order process that is not overly complicated but ensures that all necessary information is passed along. If it is too complicated or there are ways to get parts without a work order, you will find employees not using the desired process and inventory inaccuracies begin to occur.

4. **Adopt security measures:**
Ensure that effective security measures are taken in the parts warehouse. Several critical practices should be considered. Limiting access to the parts warehouse inventory is crucial to maintaining inventory accuracy. Adopt a policy that parts inventories are "off limits" and only parts department employees have access.

5. **Centralize and consolidate parts:**
Where possible, centralize and consolidate satellite parts inventory into your main parts warehouse. Having all your parts centralized and consolidated can make security easier but also makes this potentially large asset easier to control and maintain inventory accuracy.

6. **Utilize an Inventory control system:**
By utilizing your ERP's warehouse functionality or a warehouse management system (WMS) -- and not spreadsheets -- to manage your parts inventory will ensure accuracy and ease of managing your parts warehouse. Also, utilizing barcodes and scanning functionality in conjunction with the system will greatly enhance the efficiency of the processes in the parts warehouse and improve on inventory accuracy.

7. **Give every part a stock location so employees can easily locate:**
Ensure that stock locations are created at the lowest detail (typically a bin and slot location for each SKU) allowed by your systems. It can be difficult for employees to locate a part if the location identifier is a shelf where many other parts are in a shared location. By instituting the above recommendations, you will be able to have better control over your parts inventory and provide faster and accurate fulfillment of work orders and other parts requests.

Multi-Echelon Inventory Optimization

1. **Boost in Cost-Efficiency:**
   Without a strong inventory optimization strategy, companies may keep more stock throughout their supply chain, so they are prepared to meet consumer demand with enough stock ready at any one distribution point. Sounds good, right? Well, unfortunately this approach is uneconomical, as well as unprofitable because it can lead to inventory excess, with too much capital tied up in stock that won't move quickly enough. Multi-echelon inventory optimization helps companies make better use of their capital, investing in optimal levels of stock that will move more fluidly throughout the supply chain.

2. **Improvement in Customer Service:**
   Without successfully optimizing their inventory levels, enterprises may end up forecasting too low, resulting in inventory deficits. This means that they could potentially be out of a certain product a customer wants or needs by the time inventory has moved downstream to the consumer. And, of course, this would hurt their customer service levels as they are not sufficiently meeting consumer demand. When companies utilize multi-echelon inventory optimization, they can successfully forecast optimal levels of stock throughout their supply network — meeting consumer needs and keeping customers happy.

3. **Better Management of Supply or Market Volatility:**
   If companies fail to optimize their inventory levels, they may not be prepared for sudden changes in market demand or supply. With multi-echelon inventory optimization, companies achieve optimal levels of stock throughout their supply chain. Having enough stock at any point throughout their distribution networks boosts an enterprise's agility, helping them more quickly and strategically respond to market and supply volatility.

4. **Better Management of Lead Times:**
   Without a strategic approach to inventory optimization, enterprises handicap their ability to manage fluctuating lead times. Since suppliers' estimates of lead times are not always accurate, sudden changes in lead times can arise, leading to stock shortages, excess stocks, etc. Multi-echelon inventory

optimization helps companies maintain optimal levels of stock throughout the supply chain network, so they can quickly adapt and respond to lead changes as they come up.

5. **Improved Return on Investment:**
Without a successful inventory optimization strategy in place, enterprises may invest too much capital in stock that is not moving fast enough through their supply chain. Multi-echelon inventory optimization allows companies to manage optimal levels of inventory — so without too little or too much inventory, they can successfully meet consumer demand. This means better profits, and better returns on investments.

The Uses of Computers in Inventory Control

Computerization has revolutionized inventory management, as technologies ranging from automatic scanners to radio frequency identification chips now allow businesses to track their inventory from the moment a company buys it wholesale to the moment the products leave the building in the hands of a customer.

1. **Receipt of Goods:**
A retail store or a central warehouse uses bar code or radio-frequency identification scanning at the point of receipt of goods. Scanning individual items or shipment pallets allows a company to itemize all shipments from the supplier, which can be compared against the purchase order for errors or losses in transit. When your business ships these goods out of the warehouse to their point of sale, a second scan can automatically tally the remaining stock in the warehouse, and send messages to the purchasing managers indicating that it is time to reorder.

2. **Retail Turnover:**
Many businesses use similar scanning techniques at the point of checkout. As of 2010, bar code scanners are more popular than RFID for this purpose. Both will automatically enter the correct price at the register and prevent data entry errors. They also can create a perfect real-time record of how much stock remains on the shelves, how much is available in on-site storage, and whether a new shipment is necessary from the warehouse. Combine this

information with warehousing data, and your business can create additional alerts to key management when a bottleneck occurs.

3. **Stock Management and Cost Reduction:**
The process of moving goods through a company pipeline is always economically inefficient. The purchase of the goods represents an investment of company capital, which your business cannot recoup until you sell your inventory. Warehousing of goods before sale introduces the possibility of inventory shrinkage in value from theft, damage, deterioration or changes in customer taste. Moving goods from warehouses to the point of sale involves shipping costs, especially if the shipment is incorrect, or if the internal shipping process is inefficient. Computerization provides a real-time picture of this entire work flow process, and allows managers to reduce purchasing costs through minimizing inventory, increase the efficiency of internal shipping systems, and reduce the possibility of theft or damage by being able to track each item down to the individual staffer who takes responsibility for it.

Criteria and Methodology of Evaluation

FIFO – First In, First Out or FIFO takes the oldest unit of a product that you have in your inventory and applies its cost to every other unit of that product in stock. It doesn't matter if newer ones weren't purchased at the price.

LIFO

Last In, First Out or LIFO is, of course, the opposite of FIFO. It takes the newest copy of a product that you have received into your inventory, and it uses it as a reference point for every other unit of that product. Again, it doesn't take into account if older units were purchased at different prices.

Average Cost

The Average Cost takes the mean cost of every unit of a product that you have in your inventory. This helps to account for the changes in price that occur over time between the oldest and newest products you have in stock.

Standard Cost

The Standard Cost of a product is calculated by adding up all of the costs on the product's bill of materials, including all of the parts, raw goods, and labor that go into it.

Actual Cost

Last but not least is the Actual Cost. This cost is determined by adding up all of the costs on a product's work order and comparing them to the final costs incurred from actually doing the work and completing the product. Basically, if you find that the real-world cost doesn't match the one you had on paper, you go with the former rather than the latter as the actual cost of that product.