

**A
PROJECT REPORT
ON**

**“ Warehouse Management- India Part
distribution Center (IPDC) Cummins “**

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“MIT School of Distance Education”

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Post Graduate Diploma in Management

Logistics and Supply Chain Management

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SUBMITTED BY

“MISS .APARNA LAXMAN KAVARE”

STUDENT REGISTRATION NO.: MIT2022N01449



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Student ID: MIT2022N01449

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I hereby declare that this project report entitled “**Warehouse Management- India Part distribution Center (IPDC) Cummins**” bonafide record of the project work carried out by me during the academic year 2022-2024, in fulfillment of the requirements for the award of “Post Graduate Diploma in Management Logistics and Supply Chain Management ” of MIT School of Distance Education.

This work has not been undertaken or submitted elsewhere in connection with any other academic course.

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Name:

MISS. APARNA LAXMAN KAVARE

StudPent ID: MIT2022N01449

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Sign:-

Name:-



MISS. APARNA LAXMAN KAVARE

Student ID: MIT2022N01449

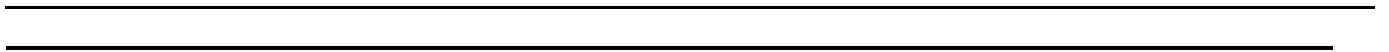
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1.INTRODUCTION

A solid warehouse operation is at the foundation of every successful retail brand. It's an area that could either destroy your business. Or propel it into something customers trust time and time again. But getting it right is no simple task. That's why we put together this complete guide to warehouse management. We cover everything needed to run your warehouse like clockwork – from how to arrange it, to best picking and packing processes and even choosing an effective Warehouse Management System.

Big Commerce's Omni channel Retail Report found that:

80% of respondents ranked shipping cost and speed to be "extremely influential" in where they shopped. With price being deemed the only purchasing factor more persuasive.

2.WHAT IS WAREHOUSE MANAGEMENT?

Warehouse management is the act of organizing and controlling everything within your warehouse – and making sure it all runs in the most optimal way possible.

This includes:

- Arranging the warehouse and its inventory.
- Having and maintaining the appropriate equipment.
- Managing new stock coming into the facility.
- Picking, packing and shipping orders.
- Tracking and improving overall warehouse performance.
- Most high growth retailers would use automation tools (like some form of Warehouse Management System) to control this part of their supply chain.

A simple definition of a warehouse is:

'A warehouse is a planned space for the storage and handling of goods and material.' In general, warehouses are focal points for product and information flow between sources of supply and beneficiaries. However, in humanitarian supply chains, warehouses vary greatly in terms of their role and their characteristics.

The Material Handling Industry group defines material handling as the “movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption, and disposal”.

Global Warehouses

The global warehousing concept has gained popularity over the last decades stock pre-positioning becomes one of the strategies for ensuring a timely response to emergencies. They are usually purpose built or purpose designed facilities operated by permanent staff that has been trained in all the skills necessary to run an efficient facility or utilizing third party logistics (3PL) staff and facilities. For such operations, organizations use, information systems that are computer based, with sophisticated software to help in the planning and management of the warehouse. The operating situation is relatively stable and management attention is focused on the efficient and cost-effective running of the warehouse operation. Numerous organizations have centralized prepositioning units strategically located globally. Some of these offer extended services to other humanitarian organizations on a cost-plus operating charges basis. The United Nations Humanitarian Response Depot (UNHRD) Network.

Field Warehouses

Field Warehouses are usually temporary in nature. They may be housed in a building which was not designed to be used as a warehouse, in a temporary building/structures, and are often in mobile units (rub halls, Wiikhalls) that are little more than a tent in a field. The initial staff may be a casual workforce that has never worked in a warehouse before and the inventory system is more likely to be paper based. Often the situation is initially chaotic, sometimes dangerous and coupled with a humanitarian need which may be very urgent. The management style must therefore be practical and action oriented with a focus on making the humanitarian goods available as quickly and efficiently as possible, while being accountable at the same time.

3. TYPES OF WAREHOUSES:

1. Private warehousing.
2. Public warehousing.
3. Contract warehousing.

3.1 Private Warehousing: -

A firm producing or owning the goods owns private warehouses. The goods are stored until they are delivered to a retail outlet or sold. Potential advantage of using a private warehouse is the ability to maintain physical control over the facility, which allows managers to address loss, damage, and theft. When not in use they are rent in out. The construction and maintenance of private warehousing can be extremely costly. All the expenses have to be carefully analyzed and evaluated. These are:

- i) Fixed expenses and building and land acquisition costs which are high.
- ii) Expenses incurred on ensuring that warehouses are properly equipped with material handling equipment's like conveyors, forklifts, hand trucks, racks and bins, and dock levelers.
- iii) The costs of salaries of staff required for peak activity periods which can be very high since retrenchment during slack periods may not be possible.
- iv) Extra payment to be made for work on Saturday and Sunday and holidays.
- v) Janitor and other services charges are required to be taken into account.
- vi) The office and record keeping equipment necessary for successful warehousing operations has to be budgeted for.
- vii) To this must be added the cost of such item as fuel, air-conditioning, power, and light.
- viii) The cost of maintaining insurance records and of the premium paid for fire, theft, and also for workmen's compensation.

Advantages of Private Warehousing

The advantages and disadvantages of private warehousing as against those of public warehousing are:

- i) Private warehousing offers better control over the movement and storage of products as required by the management from time to time.
- ii) There is less likelihood of error in the case of private warehousing since the company's products are handled by its own employees who are able to identify the products of their own company better
- .iii) If there is sufficient volume of goods to be warehoused, the cost of private warehousing compares favorably with that of public warehousing. But private warehousing may not be expected to be packed up to the brim all the while.

Therefore, the costs of private warehousing per unit may actually higher.

3.2 Public Warehousing: -

A public warehouse rents space to individuals or firm needing storage, some provide wide array of services including packaging, labeling, testing, inventory, maintenance, local delivery, data processing and pricing. All the forgoing cost factors operate in public warehousing as well. But in public warehousing, the expenses are distributed over several other consignments of other clients. In most instances therefore the net result is lower cost for each. Warehousing has become a highly specialized service and a public warehouseman can render better service with greater flexibility for the user. A company running a private warehouse will have to compare costs incurred with the total figure for the complete service through public warehousing.

Advantages of Public Warehousing

- i) It is generally less expensive and more efficient.
- ii) Public warehouses are usually strategically located and immediately available.
- iii) Public warehousing is sufficiently flexible to meet most space requirements, for several plans are available for the requirement of different users.
- iv) Fixed costs of a warehouse are distributed among many users. Therefore, the overall cost of warehousing per unit works out to a lower figure.

- v) Public warehousing facilities can be given up as soon as necessary without any additional liability on the part of user. vi) The cost of public warehousing can be easily and exactly ascertained, and the user pays only for the space and services he uses.

3.3 Contract Warehousing: -

Contract warehousing is a specialized form of public warehousing. In addition to warehousing activities such warehousing provides a combination of integrated logistics services. Thus, allowing the leasing firm to concentrate on its specialty. They provide customized services. (Value-added services)

4. BENEFITS OF WAREHOUSE MANAGEMENT

i) **Optimized Space and Lower Operating Expenses: -**

Warehouse management systems optimize warehouse flow by analyzing the best use of floor space based on the task and material characteristics. In the WMS implementations, the use of space and floor plan analysis is used to

determine how space should be best used and provides opportunities for reducing waste – waste of premium floor space and waste of time for locating product. This will also lessen potential cost resulting from excessive material movement, time consuming placement, and retrieval. By considering the best locations to store products, as well as materials or equipment, a warehouse can lower its operating expenses. WMS solutions can also help maintain material rotation, whether through first-in, first-out (FIFO), last-in, first-out (LIFO), or first

expired, first-out (FEFO) practices. Whatever rotation rule is required, the WMS can help the rotation. Typically, LIFO enables cost-effective use of space, and movement. FIFO or FEFO can maintain product quality for items from aging out in the warehouse. Some solutions have additional fuzzy logic so that a slightly relaxed FIFO or FEFO reduces additional moves, for example: products that expire in the same month may be considered both eligible to be picked. A warehouse management system operates with versatility and flexibility, making it easy to form any necessary adjustments to maintain best inventory floor location selection, choice of the correct inventory to pick, and help manage physical movement and worker performance.

i) Inventory Visibility: -

Using a warehouse management system will also provide visibility of accurate, real-time inventory levels. This enables a company to more securely estimate supply and avoid backorders, which leads to more satisfied customers. Using WMS automation with scanning, RFID, or other location tracking methods ensures the visibility at the location and reduces the non-WMS enabled situations where inventory becomes forgotten, lost, or misplaced within the warehouse. Warehouse management systems work in conjunction with the enterprise ERP and

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planning functions to provide demand to forecasting functions by sharing precise information about how certain products are performing. Product demand and seasonality is reflected as items are transacted and information communicated. Therefore, with this information, planners can make reliable decisions about which products to adjust for the company to increase revenue or mitigate losses.

ii) Effective Labour: -

Considering workers' skill levels, their proximity in the warehouse, their equipment, and available warehouse tasks, a warehouse management system can better assign the right task to the right person at the right time. Optimization of travel time within the warehouse is one of the greatest benefits that the WMS can provide to improved labor utilization. The WMS can focus labor on high impact activities while finding the most well-suited laborer to perform a specific task. Using labor forecasting, the system can assign jobs on a day-to-day basis and efficiently design schedules. Scanning items during their entry into a

day

warehouse, as well as throughout their movements, can eliminate the need for work to be double-checked, saving time and speeding up the recording process. Scanning improves pick accuracy, reducing mis-picks, thus providing better customer service. KPIs can also be utilized to analyze staffing, which is important because labor is often one of the highest costs of warehouse operations. Labor efficiency, equipment efficiency, and space efficiency are optimized through appropriate work assignment.

iii) Traceable Materials: -

Inventory materials can be easily traced with warehouse management systems using lot, batch, and serial numbering. Lot/batch numbers indicate the group in which materials were made, and the serial number identifies an item specifically. By use of WMS inventory tracking as previously noted, the ability to match specific lot/batch or serial numbers with incoming receipts and outgoing shipments allows for full traceability. This ability to trace materials lowers any potential redundancy, enables accurate inventory planning and allocation, and provides current retrievable information for either future traceability, service maintenance, or recall situations.

iv) Optimized Supply Chain: -

A warehouse management system optimizes a warehouse's internal operation which can then extend to the broader supply chain. Within the warehouse, a WMS streamlines the entire warehouse process from inbound receipts to outbound deliveries improving operational efficiencies and reducing costs. Warehouse staff achieve fast and accurate shipments by reducing or eliminating unnecessary or non-productive activity. These savings in time and cost coupled with improved processes and information can then be passed along to internal and external partners enabling them to improve their own operations. For example, improved inbound receiving reduces delivery times, enabling delivery partners to better leverage their equipment and resources and shippers to better manage inventory levels.

Improved data can reduce risk and increase reliability, benefiting shippers, suppliers and customers. Data can be shared and leveraged back to an ERP or to a customer, as well as to a TMS (Transportation Management System). Product can arrive to its final customer more quickly while allowing the partners upstream to improve planning. Inventory fulfillment service can be aligned to inventory management; enabling optimized operations while reducing time & inventory carrying costs.

v) Internal Automation Benefit: -

Warehouse management systems are the enabler to leveraging additional automation technologies within a warehouse. Mobile devices can automate internal work assignments and support a transition from paper to electronic work and activity recording. This simplifies processes which increases ability

to scale and ensures information accuracy. Mobile pairing with the WMS system can allow the input process to be expanded, as access can be provided through handheld mobile devices. Automation supports ongoing improvement in existing operations through improved strategies. There are many different levels of

automation available, from automated picking and packing, robotics, analytics driven movements and AI. Warehouse management systems support these strategies by providing the foundational elements to capture, record and communicate activity. For example, sensors, barcoding, pick-to-light, voice, and automated carousels can all increase throughput when integrated

to a WMS by monitoring picking and packing activity. Use of robots and automated conveyors can streamline operations and reduce bottlenecks.

vi) Effective Shipment Management providing better Customer Service: -

Inbound and outbound planning can be efficiently managed with a warehouse system that can adjust movements of inventory and equipment. As inventory is scheduled for arrival, the exact date and time can be optimized, considering available labor and equipment for storage tasks. There is ability to plan both receiving dock doors as well as outbound shipping docks with WMS solutions. Some WMS solutions also connect to transportation management solutions (TMS) to further optimize the supply chain processes. Warehouse management systems can also pick and pack products more effectively, as managers can choose between zone, batch, or wave picking in a way that lowers any holdup or issues caused by traffic or ineffective employee locations. These picking efficiency options provide faster customer order cycle time and thus improve customer relations. Additionally, due to the inventory tracking and packing options, customers can receive early notification of shipments and how the materials are coming. The connection of customers with advanced shipping notices is better enabled with the WMS solution.

vii) Ongoing Improvement: -

As a valuable technological tool, warehouse management systems are designed to enable continuous improvements. The system can be implemented in phases to allow ongoing updates with newly developed features consistently, keeping warehouses efficient as they keep up with current changes. This also allows for the warehouse to incorporate new processes and innovations over time. And, if the warehouse management system is based in the cloud, it can update instantly, which can help reduce the need for large, expensive IT teams. Warehouse management can help companies maximize profitability and alleviate error. However, the potential obstacles to getting started with a new management system can be daunting. Clarkston can help you navigate any challenges to obtain these benefits by using our industry expertise to best assist with your implementation of a warehouse management system.

5. CHARACTERISTICS OF GOOD WAREHOUSE MANAGEMENT

- i) **Easy to use:** A good WMS should be easy to handle. This reduces the time you require to train your employees. It also reduces the time spent when setting it up and monitoring everyday operations. This applies to all employees including senior managers so that they can adapt fast to new requirements. Clear navigation guarantees you full utilization of the WMS by all employees which promotes productivity. Look for WMS with menus that are easy to follow, simplified data entry, allows you to create templates and charts. It should be able to update automatically in real time and employees can access their data easily on the dashboard.
- ii) **Maximum Functionality:** The most important thing for you to do when looking for a Warehouse Management System is to ask yourself what the system can do or solve for you. If you have fewer resources can it help you achieve more? A good WMS should reduce the workload on your end and maximize the work it can help you do. If the system can offer more warehouse management solutions with less input, then it might be good for you.
- iii) **Detailed Management:** A good WMS should allow you to manage and track every step of every transaction done in the warehouse. You need yard management software that can give you full information on employees, products and other entities

- iv) involved. Some of the basic steps the inventory management software should track include, shipping, movement of goods, inventory audits, storage of received items, picking of orders, and receiving. Good WMS should offer proper inventory management solutions.
- v) **Compatible with your Enterprise Resource Planning (ERP) Software:** For your business to keep running, you need a WMS that is compatible with your ERP Software. That means a good WMS should work with common ERP systems well. It should be compatible with JD Edwards, Infor, Activant and MS Dynamics. Also, look for a supply chain management software vendor who can develop other ERP integrations. Customers want their order to be supplied as soon as possible. This calls for effective warehouse management solutions; therefore, every retailer should look for a way to optimize operations.

6. RECEIPT AND INSPECTION OF MATERIAL

The receipt and inspection procedures comprise the activities that you must perform in LN to receive and, if required, inspect goods that you want to store in the warehouse. This topic describes all steps, also called activities, of the inbound and inspection procedures and shows how you can perform these steps.

Some of the activities are mandatory, and some only apply to location-controlled warehouses. You are not required to include non-mandatory activities in your warehousing procedures. In addition, you can specify whether an activity must be performed manually or automatically. For information on how to define warehousing procedures, see [To define warehousing procedures and Automatic or manual execution of activities](#).

The receipt and inspection procedures include the following mandatory activities:

- Warehouse Receipts
- Generate Inbound Advice
- Put Away Inbound Advice

Step 1. Print goods received note (optional)

The first step of the receipt procedure is to print a goods received note for the inbound order lines that you want to receive. The initial status of an inbound order line is either **Planned** or **Open**.

Step 2. Receive goods

The **Receipt** activity is a mandatory step of the inbound procedure. When inbound goods arrive at the warehouse, the goods are counted, and the receipt of the goods is confirmed.

Many

warehouses use scanning devices to receive goods, in which case they scan the serial numbers or the labels of the handling units of the goods. To receive goods in LN, you must create a receipt record and link the inbound-order lines, advance shipment notices, or handling units, which list the goods, to the receipt record. As a result, LN creates receipt lines for the linked inbound order lines, handling units, or ASN lines. For more information, refer to How to receive goods. If the ownership for the received goods is other than company owned, LN creates an ownership record when a receipt is linked to an inbound order line. If the ownership is consigned, LN creates a consumption record in the Consigned Receipts session. If the ownership is customer owned, LN generates a consumption record in the Customer Owned Receipts session only when the consigned inventory is used/ issued from a warehouse. For more information, refer to Inventory ownership in Warehouse Management.

You can create receipt records in the Warehouse Receipts session. Alternatively, you can create a receipt for inbound order lines as follows:

1. In the Inbound Order Lines session or the Inbound Line Status Overview session, select the appropriate menu.
2. On the appropriate menu, click **Receive**. After you create a receipt record for an inbound order line, the status of the inbound order line changes to **Receipt Open**.

After you create a receipt and link order lines, handling units, or ASNs, you must confirm the receipt. After the receipt is confirmed, the status of the inbound order line changes to **Received** and LN creates an inventory record for the received items. Note that for nonlocation-controlled warehouses, when you confirm the receipt for an inbound order line, the status changes from **Receipt Open** to **Put Away**. The reason is that for non-locationcontrolled warehouses, the inbound advice and put away activities are not available. After confirming the receipt, the goods are automatically put away. If an inspection procedure

is included in the warehousing procedure, the status of the inbound order line changes from **Receipt Open** to **To be Inspected**, which is described in step 7.

To confirm a receipt, in the Warehouse Receipts session; go to appropriate menu --> Confirm
-

->**Receipt**. For more information, refer to How to receive goods.

If this activity is performed automatically, LN both creates and confirms the receipt record.

Step 3. Advise goods

Inbound advice comprises instructions to move received and/or inspected goods to particular storage locations in a warehouse. After a receipt is confirmed, you can generate inbound advice that show the pick or bulk locations to which the goods must be moved. If the warehouse procedure defined for the inbound order line includes an inspection procedure, the inbound advice shows the inspection location to which the goods must be moved. For more information, refer to the description of the Inspect Goods, step 7 in this topic. To generate inbound advice, in the Generate Inbound Advice session, select the inbound order lines that list the goods that you want to advise and click **Advise**. You can maintain inbound advice data in the Inbound Advice session. Alternatively, you can generate inbound advice for individual order lines in the Inbound Line StatusOverview session. For more information, refer to To generate and put away inbound advice. After the inbound advice is generated, the status of the inbound order lines that list the goods selected in the outbound advice changes to **Advised**.

Step 4. Generate storage list

A storage list is a document that shows the locations where received or inspected goods must be stored. It provides more detailed instructions than the inbound advice. You can generate storage lists after the inbound advice is generated. The storage list activity is only available for location-controlled warehouses. After you generate a storage list for an inbound order line, the status of the order line remains **Advised**.

You can generate storage lists in the Generate Storage List session. Alternatively, you can generate storage lists for individual inbound order lines in the Inbound Line Status Overview session.

Step 5. Storage list

In the Storage List session, you can maintain storage list data and put away the goods listed on the storage list. If you put away the goods in the Storage List session, you do not have to use the Put Away Inbound Advice session. After you put away the goods listed on a storage list, the status of the related order lines changes from **Advised** to **Put Away**. If the warehouse procedure defined for the inbound order line includes an inspection procedure, LN creates an inspection record after the inbound advice is put away, and the inbound order line obtains the **to be Inspected** status.

Step 6. Put away goods

After the receipt is confirmed and the inbound advice is generated for the inbound order line or the handling unit, you can store the goods in the warehouse.

You can put away goods using the following sessions:

- Put Away Inbound Advice
- Inbound Advice Inbound Line Status Overview
- Storage List

After the inbound order line is put away, the order line obtains the **Put Away** status. For more information, refer to [To generate and put away inbound advice](#). If the warehouse procedure defined for the inbound order line includes an inspection procedure, LN creates an inspection record after the inbound advice is put away, and the inbound order line obtains the **to be Inspected** status.

Step 7. Inspect inbound goods

The inbound inspection procedure is one of the main warehousing procedures in LN. The inspection procedure is optional, because not every warehouse, supplier, and item require inspection. You can also perform inspections for outbound goods. For further information on outbound inspections, see [The outbound procedure](#). You can move inbound goods to an inspection location after the receipt is confirmed and the inbound advice is put away to an inspection location as described in the previous steps. Inbound order lines that

are put away to the inspection location obtain the **to be Inspected** status. At the inspection location, you can approve, reject, or destroy goods. You can maintain inspection data in the Warehouse Inspections session. For non-location-controlled warehouses, the status of an inbound order line changes **to be Inspected** after the receipt is confirmed. To enhance efficiency, you can consider setting the inbound advice to the inspection location to automatic. For the approved quantity of an inspected order line, you must again generate the inbound advice and put away the inspected goods if the warehouse is location controlled. To generate and put away inbound advice for inspected goods, proceed in the same way as described in the previous steps. The status for inbound order lines for which inbound advice is generated after inspection is **Advised**. The status for inbound order lines that are put away after inspection is **Put Away**. For more information, refer to Approvals and inspections. For non-location-controlled warehouses, the status of an inbound order line changes to **Put Away** after the inspection is completed. The reason being the Generate Inbound Advice, Generate Storage List, Storage List, and the Put Away Inbound Advice activities are unavailable for warehouses without locations.

7. ISSUE OF MATERIAL

The entering of issues as part of the order procedure for production orders is required to issue the necessary materials from the warehouse to the shop floor. Issuing can be done manually or by the system while the estimate is being built up. When backflushing applies, issuing of inventory is automatically carried out.

Back flushing

The automatic issue of materials from inventory, or accounting for the hours spent manufacturing an item, based on theoretical usage and the quantity of the item reported as complete. For more information, refer to Backflushing.

Floor stock

A stock of inexpensive material present on the shop floor that can be used in production without recording each issue of material individually. Floor stock is not backflushed and is not part of the estimated costs. To account for floor stock materials, a surcharge is added to the cost price of an end item. A Kanban triggers the supply of floor-stock items to the shop floor. You can create a warehousing order of type **SFC Production** in which you determine from which warehouse and to what work center the material must be shipped. **Controlled material issue**

Material is issued from the warehouse to the shop floor in a user-defined way. You can choose to take tight control over the issue process, or you can choose to control the issue process more loosely. In general, the issue of material goes through the following stages:

•Allocate material in the warehouse

A planned production order results in planned inventory transactions. These transactions are used for planning purposes by the MRP planning engine. As soon as a production order is released, warehouse orders are created, which means that the material in the warehouse is allocated for the production order. All materials specified in the bill of material (BOM) are allocated in the warehouses, which is reflected in the Estimated Materials session. If you use shop floor warehouses, you can determine the moment that the material is allocated in the shop floor warehouse.

•Specify quantity to be issued

You must specify the material quantity that you want to issue. Depending on the setting of the **Manual Issuing** check box in the Shop Floor Control Parameters session, LN automatically specifies the planned quantity, or you can manually specify the material quantity. Note that the material quantity is still blocked in the warehouse.

▪**Release material**

If you release the material in the warehouse, the material becomes unblocked, which is a signal for the warehouse employees to start the warehouse outbound procedure.

▪**Carry out the warehousing procedure**

A user-defined warehouse outbound procedure is carried out.

▪**Receive material**

The desired material quantity is received on the shop floor.

To handle material from the warehouse to the shop floor, and from the shop floor to the warehouse, you can use the Material to Issue for Production Orders session. To handle material in a more detailed way, you must use the Production Warehouse Orders session. Particularly in case of serialized items or lot-controlled items, it is recommended that you use this session. All actions on material are laid out in so-called production warehouse orders, which you can view in the Production Warehouse Orders session.

8. STOCK AND INVENTORY MANAGEMENT

Stock or stock inventory is the collection of all the materials and goods stored, whether for use to complete the production process or for sale to the customer. Efficient management of warehouse stock is a challenge for logistics companies or companies that have a warehouse or distribution center since the management of the stock inventory stored will largely depend on the business's profitability.

The importance of stock in a warehouse

Stock accumulation and storage is important because, firstly, having stock avoids any shortage in the product the company works with; secondly, the more units, the lower the unit cost of the product in general; and thirdly, having the product stored enables immediate availability to meet the customer's demand. What's more, stock management is just as important as the stock itself. Any imbalance (depletion of stock, excess stock, etc.) in the amount of stock stored may reduce the company's competitiveness.

Types of stock or inventory

1) Types of stock from the functional perspective:

- i) **Cycle stock:** this is the stock of a warehouse to meet regular demand over a long period of time.
- ii) **Safety stock:** this is the stock to meet unexpected demand or demand in exceptional circumstances that have caused problems (for example, unexpected delays).
- iii) **Seasonal stock:** this is the seasonal stock for products with sales that increase sharply at certain times.
- iv) **Recovery stock:** these are those products that can be reused partly or totally.
- v) **Dead stock:** this is the inventory of obsolete merchandise that cannot be reused, and which must therefore be removed from the warehouse.
- vi) **Speculative stock:** if it is expected that the sales of a particular product are going to increase in the short term, the stock of that product is increased before there is any increase in demand, and it is therefore stored at lower cost.

2) Types of stock from the operational perspective:

- i) **Optimal stock:** the optimal stock level is that stock which offers us maximum profitability. Or rather, it is the stock that maintains the balance between an adequate response to demand and maximum profitability of storage costs.
- ii) **Zero stock:** it is the amount of stock associated with the Just In Time (JIT) management system, which is characterized by serving on demand, and therefore minimizing the inventory of stock in the warehouse. Zero stock is characteristic of the automotive sector.
- iii) **Physical stock:** physical stock is the amount of stock available at any given moment in the warehouse.

- iv) **Net stock:** this is the result of subtracting unmet demand from existing stock in the warehouse.
- v) **Available stock:** this is the result of adding to the inventory or physical stock in the warehouse and the orders in progress to suppliers less the unmet demand.

9. INVENTORY MANAGEMENT METHODS

1) FIFO (First in First Out) method:

With the FIFO stock management system, the first goods to leave the warehouse racks will be the first ones that entered it. It enables optimum stock rotation and is perfectly adapted to the storage of perishable products. Some of the industrial racking systems that are adapted to this management method are the live storage systems for pallets and the drive through compact system. The pallet shuttle system is also adapted to this method. To determine whether this is the appropriate method for managing your warehouse stock, discover the advantages of the FIFO system.

2) LIFO (Last in, First Out) method:

With the LIFO inventory management method, the last unit load to enter the warehouse will be the first one to leave it. It is an ideal method for non-perishable products, that do not expire or lose value over time. The stock is stacked accessibly on the racks, with easy access to it when required without having to move the rest of the unit loads. The push-back racking or drive in pallet racking systems are ideal solutions for applying the LIFO stock management method in the warehouse. The shuttle system offers plenty of versatility and can also be applied in this stock management system. See more key aspects about the LIFO system.

3) ABC management method:

In the ABC stock management method, stock is classified into three categories: A, B and C.

- **Category A:** these are the **products of highest stock inventory value** and which therefore require closer observation. They normally occupy 20% of stock. The control of this stock is vital to avoid stock depletion and all of the problems associated with this. Generally, these products occupy the lowest positions of more direct access on the industrial racking.
- **Category B:** According to the ABC management method, this stock requires less control by the company, as it **rotates less**, so the inventory is normally updated in batches, not by units. It represents about 30% of warehouse stock. It is placed at an intermediate height on the racking or in another less central area of the warehouse.
- **Category C:** these are the items that **rotate the least** and can represent up to 50% of inventory. **This stock is simple to control** because it hardly rotates. Generally, it is replenished as soon as it leaves the warehouse. It normally occupies the highest parts of the racking or other less central areas of the warehouse.

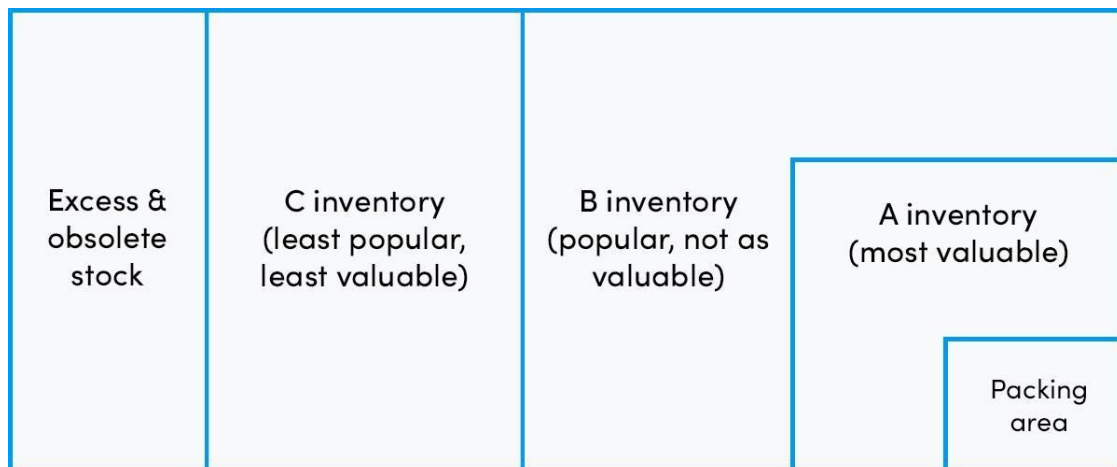


Fig 1: - ABC Management Method 4)Just

In Time (JIT) model:

Any organisation that is managed by the Just in Time (JIT) inventory management model has the just the right amount of raw materials for each moment of the production process, with minimal storage needs. It requires very strict organisation to avoid delays or cause stock depletion. The automotive sector is the clearest example of this.

5) Wilson's model or optimal order model:

Wilson's model for stock management determines the volume or quantity of the order to be placed, so as to optimize the stock management system. It is calculated when and in what quantity it is necessary to order the stocks. The mathematical formula takes into account the annual demand for the raw material, the cost of the order and the cost of storage. In conclusion, warehouse stock management is a differentiator in an organization's performance and there are many factors to consider when deciding how to manage the flow of goods: the type of stock, resources to control it, planning and forecasting of purchases, relationship with suppliers and the storage capacity of the facilities.

10. MATERIAL STORAGE AND HANDLING SYSTEMS

Material Storage and Handling Systems provide effective utilization of space and physical movement of product in a logistics facility. Storage systems allow for the traditional warehousing of product or for the temporary storage of goods awaiting processing. Handling systems contribute to faster, more ergonomic, movement of product and are especially important to a facility's ability to accommodate peak throughput requirements.

Distribution Design provides analysis and design services for storage and handling systems.

Specific services include:

- Evaluation of existing storage and handling systems
- Determination of how long the existing systems will support your operation
- Recommendations for accommodating expansion
- Capacity and throughput requirements at peak
- Storage equipment type, quantity, and layout
- Processing and fulfillment equipment type, quantity, and layout
- Conveyor and serration system design

- High speed pick/pack item sortation
- Lift truck requirements
- Non-powered equipment needs
- Budgetary costs and justification
- Bid specification preparation
- Vendor selection assistance
- Purchasing and contract assistance
- Implementation planning and assistance
- Post implementation evaluation

Certain principles have evolved to guide facility layout to ensure efficient handling of materials. Although, there are no hard and fast rules, they do provide effective guidelines for the efficient movement of materials in most facility layouts.

Principle 1: Materials should move through the facility in direct flow pattern, minimizing zigzagging or backtracking.

Principle 2: Related production processes should be arranged to provide for direct material flows.

Principle 3: Mechanized materials handling devices should be designed and located so that human effort is minimized.

Principle 4: Heavy and bulk materials should be moved the shortest distance during processing.

Principle 5: The number of times each material is handled should be minimized.

Principle 6: Systems flexibility should allow for unexpected breakdowns of material handling equipment, changes in production system technology, etc.

Principle 7: Mobile equipment should carry full loads all the times.

These seven principles can be summarized as follows:

1. Eliminate Handling: If not, make the handling distance as short as possible.

2. Keep Moving: If not, reduce the time spent at the terminal points of a route as short as possible.

3.

4. **Use simple patterns of material flow (the simplest path is a straight-line path of flow which minimizes the handling distance between two points).** If not, reduce backtracking, crossovers and other congestion producing patterns as much as possible.
 5. **Carry pay loads both ways:** If not, minimize the time spent in ‘transport empty’ by speed changes and route locations.
 6. **Carry full loads:** If not, consider increasing the size of unit loads, decreasing carrying capacity, lowering speed, or acquiring more versatile equipment.
 7. **Use Gravity:** if not, try to find another source of power that is reliable and inexpensive.
- In addition to the above guidelines, there are certain other very important aspects of materials handling, such as the following:
- a. Materials handling consideration should include the movement of men, machine, tools and information.
 - b. The flow system must support the objectives of receiving, sorting, inspecting, inventorying, accounting, packaging and assembling.

Since the consideration and objectives do conflict, it is essential to take a systems decision followed by delicate diplomacy to establish a material movement plan that meets service requirement without subordinating safety and economy.

11.WAREHOUSE WORK FLOW

The process of physical handling of goods in and out of the warehouse is an extensive and costly operation. To keep costs as low as possible, it is essential that quantity and placement of the items are accurate. To have efficient warehouse processes, the company must define the warehouse in terms of layout, put-away and pick logic, as well as internal replenishment information. Warehouse Management Systems is aimed at companies that need to receive and ship products, while maintaining an optimum space usage and knowing specifically, where all products are stored at any given time. Goods can either be stored in predefined (fixed) bins or in random (floating) bins, depending on the need for optimization and the expertise of the warehouse personnel. The WMS granules provide functionality for

executing more advanced warehouse processes such as handling items within a warehouse by zone and bin

level, handling directed put-away and pick, and the development of an automated data capture system (ADCS).

The flow of inventory through the warehouse can be divided into three basic processes:

- Receiving items at the warehouse and making them available.
- Handling items for internal distribution/movement/production.
- Picking and shipping items to customers or other locations.

Each process can consist of a series of warehouse handling activities. Receiving items involve the physical receiving of items when they arrive at a warehouse and then putting them away (from the receiving area into the stocking/handling area). WMS also provides the crossdocking functionality as part of the receiving process. Cross-docking is a means of saving time and effort by directing items on

orders awaiting shipment from the receive zone directly to the ship zone without placing them into storage. Handling items involves repacking or completing items for sale, inventory counting, supplying production, or simply moving for optimization of space. Shipping items involves picking items from inventory and handing them to the shipping agent whom delivers them to customers. To have an efficient operation, warehouse managers must know which items are to be shipped or are to be used in production and which are expected to arrive. In this way they can estimate the expected workload and allocate warehouse resources accordingly. Employees in sales and purchase departments need to be able to see what stage in the warehousing process a particular order has reached. The WMS is designed to work with the inbound, outbound and internal flow of items through the warehouse. The following illustration depicts the WMS overall workflow.

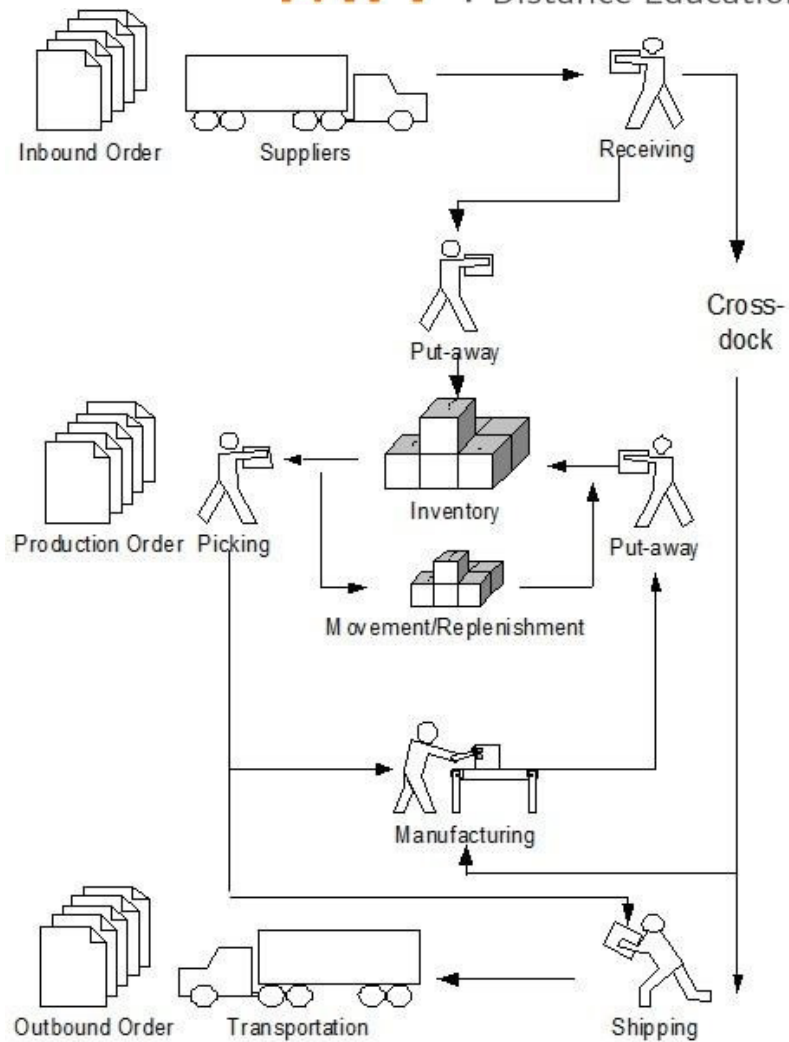


Fig2: - Flow of Inventory in Warehouse

12.ARRANGING YOUR WAREHOUSE

Probably the most important first step in optimizing your warehouse operations is making sure you have everything in their arranged in the most efficient way. Here's what you need to think about:

12.1 General Warehouse Layout

Planning the layout of your warehouse is centered on balancing two things: Providing enough storage space for your inventory; While still having enough working space for staff to move around and complete their tasks. And this generally requires (although it depends on individual business requirements) having a space designed to house the following areas:



Fig3: - General Warehouse Layout

This can be tricky – especially when dealing with a limited space. So it’s best to sketch out your warehouse layout to scale before setting it up or changing what you already have.

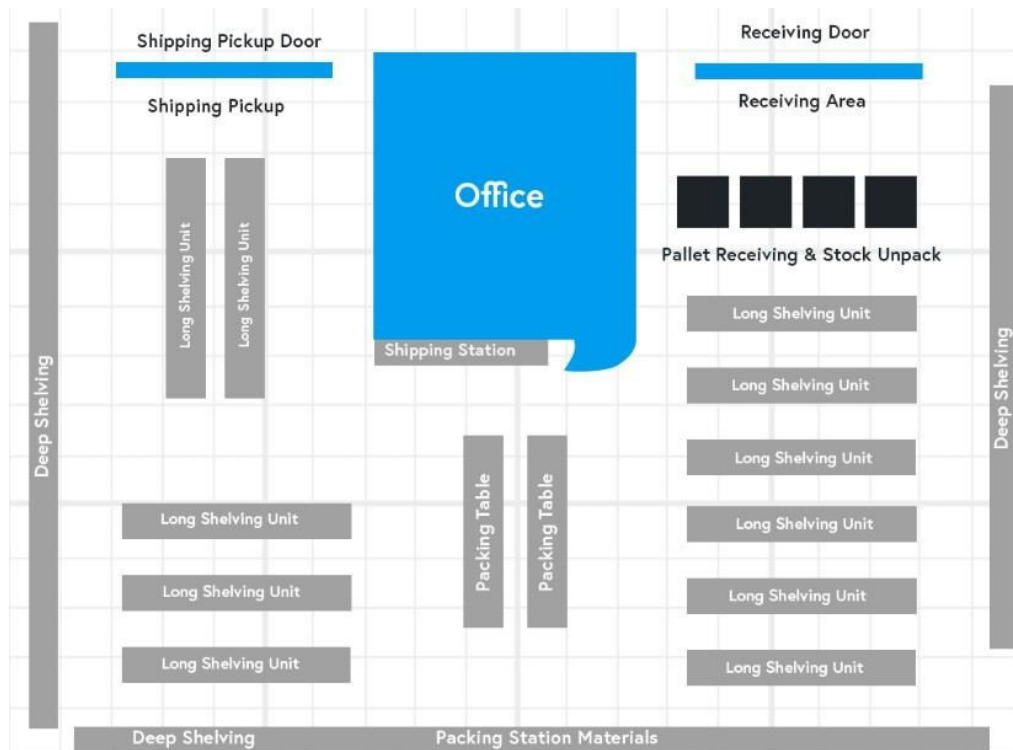


Fig 4: - Warehouse Layout

Using a grid system makes planning this a lot easier. Space and maneuverability is a key thing to remember. Pickers need to be able to walk up and down aisles without getting in each other's way. And should also have enough room to pick items.

12.2. Labeling Areas of Your Warehouse

Effective warehouse management can't be done without set location names for stock that have been clearly labelled. Your team should be able to look at your warehouse system and see exactly where any product is located. Practicality is king here. Sticking with simple alphanumeric combinations makes it easier to understand and decipher for pickers trying to reach that site location. For example, you can start by simply including labels for specific rows, shelves and then exact bin locations:

Row	Shelf	Bin
A	A	1
A	A	2
A	B	1
B	A	1
B	A	2
B	B	1

Fig 5: - Labelling Areas of Warehouse

So, you always know, for example, that all your blue t-shirts sized medium will be in Row A – Shelf B – Bin

1. And the pattern can be continued like this.

Bigger warehouses with more rows may need to add a little more detail:

Row	Shelf	Bin
A1	A	1
A1	B	2
A2	A	1
A2	B	2
B1	A	1
B1	B	2

Fig 6: - Labelling Areas of Warehouse

And then even larger warehouses may even need to be split up into different areas for each row and the facility as a whole:

Warehouse Area	Row	Row Area	Shelf	Bin
Area 1	A1	RA1	A	1
Area 1	A2	RA2	B	2
Area 1	B1	RA3	C	3
Area 2	A1	RA1	A	1
Area 2	A2	RA2	B	2
Area 2	B1	RA3	C	3

Fig 7: - Labelling Areas of Warehouse

How detailed you go with labelling depends totally on the size of your facility or site, complexity of your warehouse operations and a range of other factors. But in short: The bigger your facility, the more in depth you'll need to go with your location labelling to achieve optimal warehouse management.

13. DON'T BE AFRAIDT OR EARRANGE

A small final point in this warehouse management section is this: Don't be afraid to rearrange your warehouse. Yes – it can take time and resources to implement and may seem like more hassle than it's worth. But an optimally arranged warehouse can save bags of time overall and severely reduce costs for entirety of your supply chain management. While inefficiencies can seriously hamper growth. So regularly evaluate and – if necessary–rearrange or upgrade. For example, it may be that your best selling products in summer become your worst selling come winter, and vice versa. Or you sell more of specific products on Valentine's Day or other key retail dates through the year. So it makes sense to rearrange these products in line with this when the time comes – moving some closer to the packing desks and others farther away.

14. RECEIVING AND MANAGING NEW STOCK

Stock doesn't just appear out of nowhere. And so a critical part of warehouse management is being able to receive, unpack, put away and book in new inventory as efficiently as possible. The faster this happens, the sooner that stock becomes available for sale. And what's more, any errors or inefficiencies in this process will then cascade through the remainder of the entire supply chain. Here's what you need to consider:

Receiving Via Digital Mobile Scanner: -

It's worth noting that a mobile scanner device can make this whole booking in process much quicker and more accurate. Rather than needing to sit at a computer and individually find and update each product, you'd simply:

1. Scan a product or purchase order
2. Update inventory levels on the mobile screen - making the inventory available for sale.
3. Put it away in the warehouse - making it a much easier and quicker Process.

15. WAREHOUSE MANAGEMENT FULFILMENT STRATEGIES

Being able to fulfil orders quickly and accurately is an absolute staple of good warehouse management. After all, it's pretty much the entire reason for the warehouse existing in the first place. Here's what you need to think about when it comes to picking, packing, shipping and your distribution strategy in general: Picking may seem like a simple concept at first. And it is – when you only have a few orders to deal with. But this becomes a much different story once you're dealing with hundreds (or even thousands) of multiple item orders each day. In fact: Research we recently conducted on 20 Veeva retailers found that 70% of labour time when processing an order is spent on just picking the products. And 60% of a picker's time is taken up by simply walking around the warehouse. These are the **four main picking systems** or methods used by medium to large retailers:

Single order

This is the most basic picking method – typically only used by those just starting out. Quite simply, a picker will pick one order at a time in its entirety before moving on to the next. **Best for:** Retailers just starting out who aren't yet big enough to gain the benefits of more complex picking methods.

Avoid if: You ship more than 20 customer orders a day (or plan to in the near future).

Batch picking

The picker is assigned a batch consisting of a few orders, picks them all in one go and then returns to a packing desk.

The picker will then get assigned a new batch to pick. The number of orders allocated to each batch is generally between 10 and 30. But this really depends on the physical size of your products and average order size.

Best for: High number of orders with single or low number of products per order.

Avoid if: You have a high number of products per order (or are aiming for this in the near future).

Zone picking

This sees each picker assigned their own area (or zone) of the warehouse with them only picking products stored in that specific zone. An order is passed through all areas to have any required items added to it by pickers in that zone before being returned to a packing desk. Great for preventing multiple pickers getting in each other’s way, but it can also create a slight delay in shipping as each order needs to be passed around the warehouse.

Best for: Retailers typically shipping a high volume of multiple item orders.

Avoid if: You typically ship single or low item orders or have very few pickers.

Wave picking

Similar to zone, but all zones pick at the same time. The various items are picked in the according zone and are then given to a packer who will consolidate all the separate picks for each order. This is faster than zone, but labour costs increase due to the packer needing to spend more time combining orders at the end before needing to be shipped.

Best for: Retailers typically shipping a high volume of multiple item orders and still wanting to maintain a super-fast process.

Avoid if: You typically ship single or low item orders, have very few pickers or cost is more important than speed of dispatch.

Here’s a quick summary of all four methods:

Picking Method	Order Volume	Items per Order	Best For	Setup Cost
Single order	Low	Med-High	Startups	£
Batch	Low-High	Low-Med	High volume of single item orders	££
Zone	High	Low-Med	High volume with a lot of products per order	££££
Wave	Med-High	Med-High	High volume with multiple items per order	££££

Fig 8: - Warehouse Picking Method

16. MEASURING WAREHOUSE PERFORMANCE

Tracking performance and working to improve it is essential when it comes to all parts of supply chain management. And it's no different when it comes to warehouse management. In general, this is all about two things:

1. Accuracy of fulfilling customer orders (without damage).
2. Speed of fulfilling customer orders (without damage).

The main **KPIs** you want to be tracking to measure the success of your warehouse management process:

Receiving efficiency

This is quite simply how long it takes for your team to complete the receiving and putting away of a newly delivered purchase order. It's a good idea to record exact timestamps for:

New stock being delivered.

When this stock is ready for putting away. Then again once the stock has been put away. You can then calculate the difference in time between each point and work out an average for the month allowing you to see how performance is trending in this area of your warehouse operations.

Rate of return

An order being returned isn't always down to a problem in the warehouse – a customer may have just had buyer's remorse. So the key to getting best use out of this is to segment by reason for return. This way, the warehouse or operations manager can start looking at exact reasons why this KPI may be high and put into place strategies to resolve. Determine several different return reasons and use the following equation to analyse each one:

$$\text{Rate of return} = \frac{\text{No. of units returned}}{\text{No. of units sold}} \times 100$$

Tracking and segmenting rate of return properly lets you also analyze picking accuracy – a particularly key piece of data. To calculate picking accuracy, use your total number of orders in a period along with data from the rate of return KPI in the following equation:

$$\text{Picking accuracy} = \frac{(\text{Total no. of orders} - \text{incorrect item returns})}{\text{Total no. of orders}} \times 100$$

Order lead time

Order lead time (or average order processing time) is quite simply how long it takes for a customer to receive an order. You may want to divide this into various categories. For example, international orders, Amazon Prime orders or orders for special or larger products. But generally, the lower you can get order lead time, the happier your customers are going to be – so long as it arrives in perfect condition.

17.CHOOSING A NEW WAREHOUSE MANAGEMENT SYSTEM

Warehouse Management Systems (WMS) or management software of some kind can basically take a huge chunk of the leg work out of all the above processes. They'll automate and digitize as much as possible.

Making it much easier to:

- Keep everything organized, tracked and documented.
- Pick with as close to perfect accuracy as possible.
- Speed up your entire logistics operation.

But it can be tough sifting through all the information to decipher when to upgrade and what to look for in your management software. When to upgrade to a Warehouse Management System. As with many things, it's totally dependent on your individual business needs if/when you're ready to upgrade Warehouse Management Systems. Or even just start using a WMS rather than continuing to manage manually.

18. QUESTIONS TO HELP DECIDE WHEN TO UPGRADE WMS

Is your current process achieving a 99.9% picking accuracy rate? If not, how costly is each incorrectly picked order to the business?

- What are your other warehouse KPIs looking like? And how beneficial would improving each one be?
- How many team members is it taking to run your current operation? And would it be more economical to replace some with a Warehouse Management System or piece of software?
- How many orders are you dealing with each day? And how much annual turnover is this generating?
- Have you been achieving growth targets? And how quickly do you plan to grow in the short to medium future.

19. WHAT TO LOOK FOR IN A WAREHOUSE MANAGEMENT SYSTEM

Finding the correct Warehouse Management System for you depends on a variety of aspects unique to your business. But here are the main things medium to large retailers need to think about when deciding:

- Warehouse organisation. Stores exact locations for every SKU and can direct you on the best walking route to this place in the warehouse.
- Digital barcode operations. Uses mobile scanners and barcodes to minimize the need for paper and optimize accuracy when picking, packing and booking in new stock. Desired integrations. Has an integration (or an integration can be built) with all necessary stores, marketplaces, shipping partners, number of warehouses and anything else unique to your business.
- Easy-to-use system. Straightforward platform designed to be easy to operate and learn for all current, new and temporary team members. All-in-one solution. Capability to handle and manage other major areas of your retail operation – including orders, inventory and shipping.
- Reporting and accountability. Tracks and holds a history of every action in the warehouse and by which team member for high-level KPI reporting and staff accountability.

20. ANALYSIS OF SPACE ALLOCATION FOR WAREHOUSE OF COMPANY ‘X’ AND ‘Y’

We have taken the sales data for a company X and Y for the period of last 12 months (January 2022- December 2022). A single firm owns these companies and thus their warehousing is done at the same Distribution Centre. In these companies, there are different types of product classification.

Classification of Products:

1. Based on Business Units

There are various business units present in the firms:

LOB	Legal Entity	Category
D8M CILL DBU STU	CIL	Parts
DDS- CSS-REPOWERING OPS	CIL	Parts
Auto	CIL	Parts
Channel Parts (4S)	CIL	Parts
Direct / OEM	CIL	Parts /Filter
Direct / OEM (D9N /NAVY)	CIL	Parts
Auto	CIL	Filters
Channel Parts (4S)	CIL	Filters
EDO + Intercompany	CIL	Parts
DBU Billable		
ISO	CIL	Parts
MINING	CIL	Parts
NEB	CIL	Parts
DBU Total		
ABU (AM2 Domestic)	CIL	Parts
Parts P/L (AM2 Exports)	CIL	Parts
CIL Total		
CA1 AC1	CTIPL	Parts

20.1 PROPOSED PLAN:

We are proposing 2 Product Storage & Distribution Plans for different product classification.

1. Volume-wise distribution and storage of BUSINESS UNITS for companies X and Y.
2. Volume-wise distribution and storage of DIVISION WISE PRODUCTS for companies X and Y.

20.2 VOLUME-WISE DISTRIBUTION AND STORAGE OF BUSINESS UNITS FOR COMPANIES X AND Y

After analyzing the given data with the help of Pivot Tables, Lookup and indexing features of Microsoft Excel, the following results are obtained.

LOB	Legal Entity	Category	Amount Forecast	Actuals
D8M CILL DBU STU	CIL	Parts	0	2.54
DDS- CSS-REPOWERING OPS	CIL	Parts	0	1.18
Auto	CIL	Parts	14	13.68
Channel Parts (4S)	CIL	Parts	62.9	65.39
Direct / OEM	CIL	Parts /Filter	8.9	11.4
Direct / OEM (D9N /NAVY)	CIL	Parts	9.1	5.86
Auto	CIL	Filters	3	4.54
Channel Parts (4S)	CIL	Filters	21	21.55
EDO + Intercompany	CIL	Parts	5.5	2.12
DBU Billable			124.4	128.24
ISO	CIL	Parts	10	8.27
MINING	CIL	Parts	4.6	8.16
NEB	CIL	Parts	1.5	4.43
DBU Total			140.5	149.1
ABU (AM2 Domestic)	CIL	Parts	2	1.12
Parts P/L (AM2 Exports)	CIL	Parts	11	8.81
CIL Total			153.5	159.03
CA1	CTIPL	Parts	17.2	21.66

Fig 10: Business Units wise breakup of sales invoices The table gives a clear idea about the

			0	0
Total IPDC			170.7	180.69

following parameters:

1. Number of Invoices Generated
2. Quantity of Business Unit
3. Volume-Wise Distribution of Business Units

The results show that the most frequent Business Unit for the company X is BU RUNNING followed by BU ACCESSORIES and so on.

For company Y, the most frequent Business Unit is found out to be BU RBK TRAINING followed by BU RBK RUNNING and so on.

The percentage distribution of each business unit gives us the relative storage allocation in the warehouse for each unit.

This can be shown as a Pie chart as follows:

Fig11: Pie chart showing Volumetric distribution The Bar Graph is shown as follows:

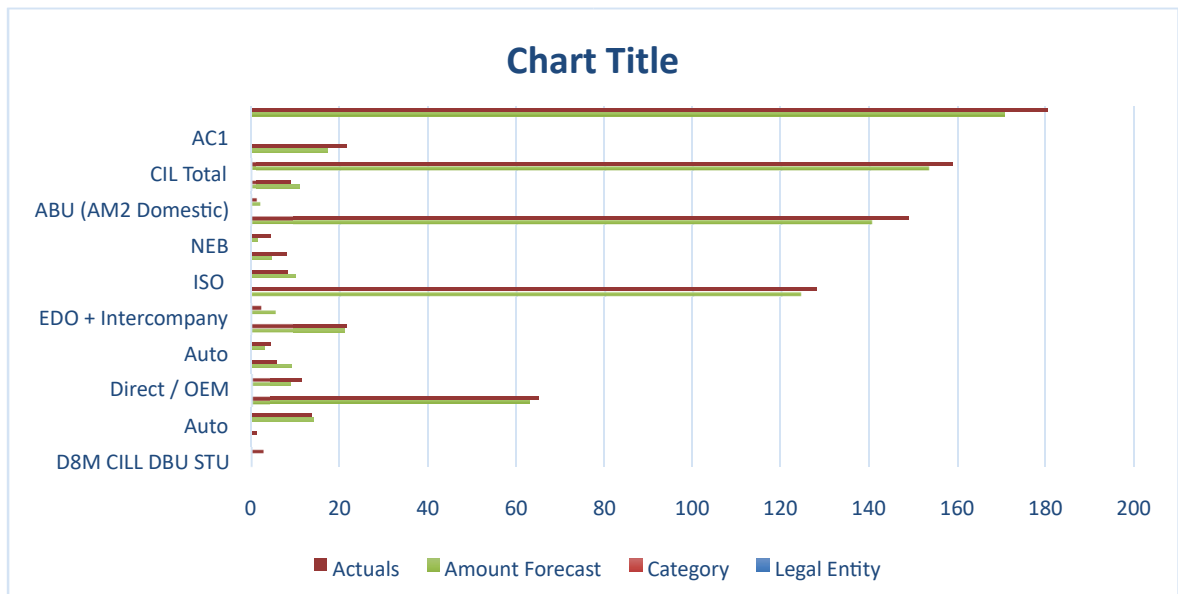


Fig12: Bar graph showing volumetric distribution

This shows that:

1. For Company X, the order of product sales in terms of divisions is FOOTWEAR> APPARELS> ACCESSORIES & GEARS.
2. For Company Y, the order of product sales in terms of divisions is FOOTWEAR> APPARELS> ACCESSORIES & GEARS.

Thus, Overall Footwear division is the most frequent division of all.

Knowing the percentage distribution of different Divisions, we can allot the storage area such that the most frequent division takes the most space followed by the other divisions having less volume of sales.

20.4 SIMPLIFIED PROPOSED WAREHOUSE LAYOUT

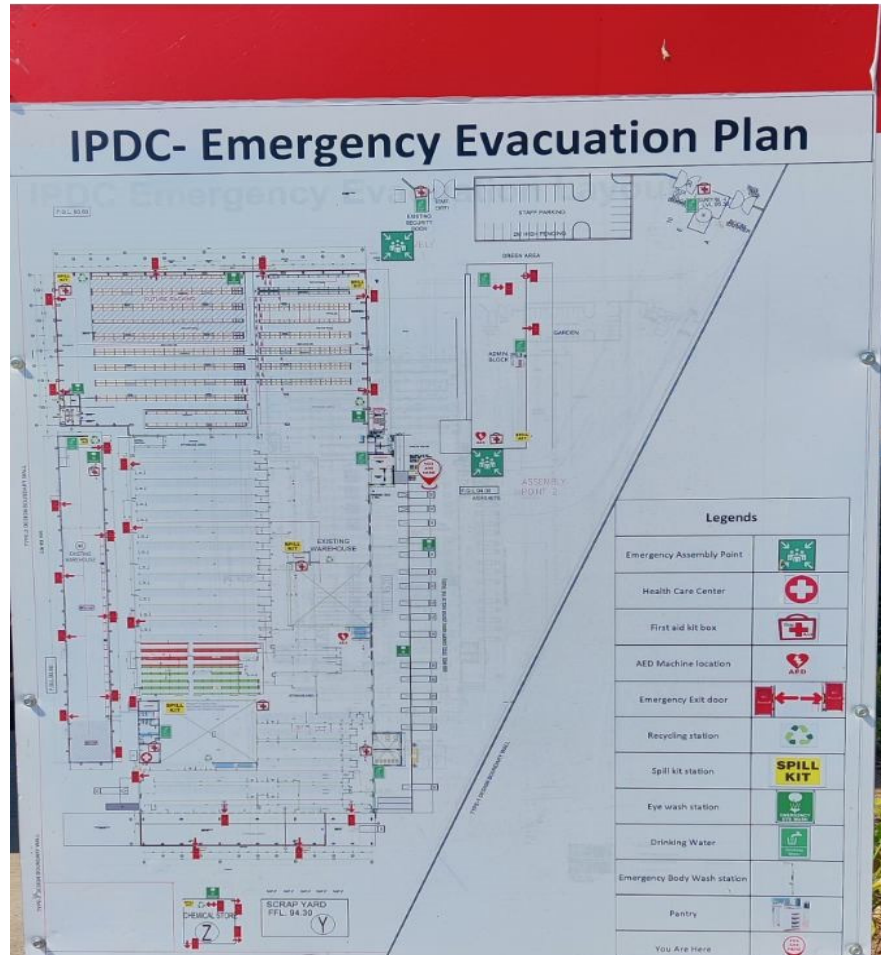


Fig 15: Simplified proposed warehouse Layout

21. FINDINGS AND SUGGESTION:

21.1. FINDINGS:

Warehouse location plays very important role in distribution channel. In continuous production or in case of JIT manufacturing Warehouse plays very important role for storing and distribution of material. If we didn't arrange our warehouse as per the requirements, then its

very difficult to find or place materials within warehouse. Some materials are required to be placed such a way that they will come first in warehouse and go first out from warehouse. But in some case some materials come first, and they go out from warehouse at last. So arranging warehouse as per material need and requirement is very important.

21.2.SUGGESTIONS:

In continuous production or in case of JIT manufacturing Warehouse plays very important role for storing and distribution of material. If we manage our warehouse as per the requirements and by considering different flow process, then it is easy to manage all activities carried in warehouse.

22. CONCLUSION

Warehouse management is a monumentally complex task with a wide variety of plates to keep spinning. But getting it right can be the difference between retail success or failure.

It all comes down to:

- Arranging your layout properly and then organizing your inventory within this.
- Having a well-drilled system in place for staff to repeat time and time again when it comes to receiving stock and fulfilling orders.
- Measuring efficiency, then identifying and fixing problem areas.
- And knowing when it's time to invest in a digital Warehouse Management System (WMS).

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