25

METHODS OF VARIOUS MATERIAL HANDLING SYSTEMS IN WEREHOUSE

There is a large amount of heavy labour involved at warehouse and logistics worksites, such as loading, unloading and transporting cargo. Material handling device is a general term for the machines used to make this logistics work more efficient. Material handling is the movement, protection, storage and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal.

These machines perform a variety of tasks including moving raw materials, work in process, and completed products. Material handling refers to a comprehensive set of tasks, including movement, packing and unpacking, storage, protection, and control of products and materials. From manufacturing and warehousing to distribution and disposal, material handling systems are valuable to every operation. Various types of material handling systems are employed in various industries. Automotive, food & beverage, consumer goods, construction, E-commerce, healthcare, and retail, are a few examples of industries that witness a wide application of material handling systems.

LEARNING OUTCOMES

After studying this lesson the learner:

- identifies the types of MHE in warehouse;
- defines manual MHS and its merits & demerits in warehouse;
- finds the semi-automated MHS and its merits & demerits;
- explains automated MHS and its merits & demerits.

25.1 TYPES OF MHS

As a process, material handling incorporates a wide range of manual, semi-automated and automated equipment and systems that support logistics and make the supply chain work.

A. Manual Material Handling or MMH is the process of handling or moving materials using manual labour. MMH includes pushing, pulling, lifting, retrieving, controlling, carrying, and holding. Though manual, this type of handling requires the use of equipment such as manual cranes, pallet trucks, slings and hooks, short-distance conveyors, and forklifts.

B. Semi-automated material handling systems are a great alternative to full warehouse automation. Semi-automated systems will allow maintaining competitiveness without investing as much as for full automation.Semi-automation is a system that utilises automated machinery with human labour and intervention. So, the machine exists to *enhance* the processes that employees are performing.

C. Automated materials handling (AMH) refers to any automation that reduces or eliminates the need for humans to check-in, check-out, sort material, or to move totes and bins containing library material. The mechanical equipment used in AMH systems includes check-in machines, sorters, conveyors, singulators, stackers and unstackers, totes, bins, trolleys, and tote carriers.

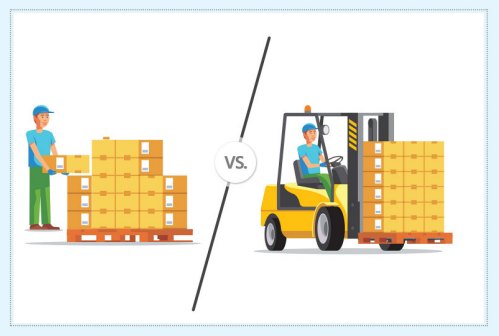

Fig.25.1: **(a) Manual Vs Semi automated MHS;**

Fig. 25.1: **(b) Automated Material Handling System**

INTEXT QUESTIONS 25.1

1. What are the different types of material handling systems?
2. The mechanical equipment used in AMH systems is _____

   a. hooks
   b. slings
   c. manual cranes
   d. check in machines

25.2 MANUAL EQUIPMENT HANDLING

It is one of the most conventional materials handling strategies in the world where operators move around the building or warehouse to locate, retrieve, and store goods and materials. Although manual, it does involve the use of powered machines such as forklifts and small overhead cranes. Manual material handling systems have a slow speed compared to the automated ones. They also lack scalability and agility as you can't program a manual system to handle more than one operation. The manual system may lead to errors and inaccuracies as they rely on human labour. But they require low initial investment costs and need to invest in training new employees. As the initial investment is low, manual material handling systems can offer a relatively quick return on your investment. As a result, they are quite popular among small and medium enterprises.

Manual material handling systems are more suitable for operations that aren't repetitive or predictable and employees may not need technical skills as they don't have to operate advanced machines. In manual material handling, you will mostly need to rely on your workers to lift, move, push, pull, store, and retrieve goods and products. However, you will need to use lifting handling equipment such as hooks, slings, manual cranes, forklifts, trucks, short distance conveyors, side-loaders, pallet jack and pallet trucks, and manual retrieval and storage equipment. Manual systems may not have higher productivity owing to the error-prone inventory management and other order fulfilment processes. It is also highly time-consuming. Improper handling of heavy loads and the injuries and deaths resulting from these errors are a primary concern for manual material handling systems and do need safety training.

A. Merits of Manual Material Handling System

a. **Cost-Saving –** Manual material-handling does not require a heavy initial investment. It is easy to set up these systems. As initial investment is low, return on investment is quick to be realised.

b. **Easy for Employees to Adapt –** Manual material handling systems do not involve advanced technology. So, there is no intense employee training required. There is a necessity for safety training though to ensure that employees handle equipment safely.

   Since this system does not require employees to have technical expertise, it becomes easier for them to adapt to the new environment.

c. **Availability of Greater Space** – Manual system does not involve the use of extensive or heavy equipment, which increases the amount of usable space.

d. **Improves Process Efficiency** – Involvement of experienced and well-trained employees ensures efficient task completion. As manual factor is involved, dynamic

processes, which see a change of parameters frequently, can be completed with great efficiency.

e. **Ensures a Safe Working Environment** – With regular safety training, employers and employees become aware of the safety precautions they need to implement while handling materials manually. As a result, the workspace is safer and accidents due to negligence are minimised.

f. **Attracts Employees** – Since manual material handling depends on labour, retaining as well as attracting new employees are crucial. A good and safe workspace based on the principles of a material handling system is sure to retain and attract employees.

g. **Facilitates Better Customer Service** – Well-trained labour, increased process efficiency, and improved productivity, lead to better delivery times and increased customer satisfaction.

B. Demerits of Manual Material Handling

a. **Difficulty to Scale** – Manual material handling can be employed for only one process at a time. If your business scales up and your operation needs to handle multiple operations simultaneously, then manual handling cannot match the demand.

b. **Error–Prone** – Human intervention makes manual material-handling prone to errors and inaccuracies. For example, there could be errors in inventory management and order fulfilment.

c. **Mandatory Safety Training –** Employees need safety training to handle equipment and operations without the risk of injuries or death. Such training needs to be undertaken regularly to keep employees up-to-date with new and updated safety practices.

INTEXT QUESTIONS 25.2

1. Give examples of equipment used in manual handling?
2. What is the main demerit in manual handling?
3. _____ is more suitable for operations that aren't repetitive or predictable and employees may not need technical skills

   a. MMH b. AMH

   c. SMH d. None

25.3. SEMI AUTOMATION MHS

Semi-automation allows one to customise which portion of the warehouse is automated and which parts will be manually run. This allows you to decide how much automation your operation needs, which can range from a mostly conventional warehouse with minimal automation to one that is close to being fully automated but with minimal human interaction.

Semi-automation offers many benefits. Whether only a small fraction of the warehouse will be automated, or the majority of your operation, here are some of the advantages it can offer.

A. **Flexibility and room to grow:** One advantage of semi-automation is that you can always go to more or full automation in the future. So, you can start slowly with your operation, with the intent of going to full automation at some point once you're able to or more comfortable with it.

B. **Allows for human intervention:** Human intervention may be important for some operations. Semi-automation allows for human intervention where necessary. Due to the flexibility semi-automation offers, you are able pick and choose which processes will be automated and which are done manually.

C. **Faster return on investment:** As stated earlier, there is an investment that comes along with automating your warehouse to any degree. Even with the initial investment, the return on investments (ROI) that comes from semi-automation tends to be faster than with full automation, since these systems are typically less expensive.

Every semi-automated warehouse can look different. This is because

a. **Reduces employee error:** Many warehouse tasks such as picking and placing can become repetitive and therefore guarantees some type of human error. Using an automated system to assist with picking and placing orders will significantly decrease error rates.

   For example, pick-to-light and put-to-light are semi-automated systems that assist employees with picking and placing orders. Integrating this semi-automated element into the picking and placing process has been shown to provide up to 99.6% pick and place accuracy.

   Pick-to-light systems and put-to light systems are lighted displays attached to the pick face of each SKU. The lighting configuration can be customised to the distribution centre's needs. These displays can be fixed to any type of racking or shelving system, whether it be existing or new build.There are many advantages of implementing pick-

to-light and put-to-light systems. Such as:

- Reduction in picking and placing errors: it's been shown to provide up to 99.6% picking and placing accuracy.
- Reduced labour costs: these systems allow more productivity per operator.
- Relatively low hardware and install cost compared to other automation options.
- Low hardware and install cost for automation: these can be installed right to the pick face via a plastic channel tek-screwed.
- Shortened order fulfilment cycle times.
- Reduced training time for new employees.

b. Improves employee safety:

There are a number of ways that semi-automation allows operations to increase employee safety.

First, employees often no longer have to take on tasks that require tough manual labour. Instead, the system will perform this portion of the tasks. For example, vertical lift modules bring the product right to the picker. The product is presented at the optimal height for the picker, so they no longer have to stoop to pick a product from the bottom levels or reach up high to pick product from upper levels.

Additionally, many semi-automated systems allow for employees to be more aware of their surroundings. For example, voice picking directs the picker via a headset, so the picker doesn't have to constantly be looking down to reference paper or RF transmitters.

Voice picking systems are automated picking systems that can be much more efficient than picking via paper or RF transmitters. With voice picking, the operator does not have to 'look down' to reference their next steps. This results in higher accuracy as well as seconds saved with each step, Advantages include:

- Increased pick accuracy.
- Increased pick volume per worker.
- Reduced new employee training (up to 50%).
- Safety incidents reduced by 5% to 20%.

c. Increases picking speed:

Semi-automation can take away the repetitive tasks performed by employees. After hours of completing the same tasks, manual picking times are shown to decrease. An

automated picking system allows for the system to continually pick products at the same speed and then deliver it to an employee.

An example of this is a vertical lift module. VLMs have been shown to increase picking speed up to 800%. This is due to the machine taking on the task of presenting each item directly to the picker, so that the picker doesn't have to walk the aisles searching for each product.

Pallet runners are semi-automated deep lane storage systems that deliver pallets via a cart that runs on a track within the racking system. It's also commonly referred to as a pallet shuttle system. Pallet runners essentially allow the entire volume of your warehouse to be utilised. The carts can be outfitted to suit a wide variety of pallet designs and can be used for first-in, first-out (FIFO) or last-in, first-out (LIFO).

Some of the benefits pallet runners offers are:

- Reduced rack damage and product damage.
- High storage density (deep lanes).
- Each level is independently accessible, resulting in less honeycombing.
- Does not require particular lift trucks to operate.
- Can be designed for both FIFO (first-in, first-out) and LIFO (last-in, first-out) storage.
- Controlled product flow, not relying on gravity.
- Not affected by varying pallet weights.

A vertical lifting module (VLM) is a vertically standing, semi-automated storage system. In this system, trays are stored in the front and the back of the system, with an opening on out outside of the system that allows for product to be delivered directly to the operator.Some advantages associated with VLM's are:

- Reduced labour costs.
- Increased picking speed accuracy.
- Increased warehouse space.
- Increased control of inventory and tools.
- Improved ergonomics.
- Flexible and modular, the system can grow with you.

d. Expedite the order fulfilment process:

Semi automatic with conveyors. Conveyors can be a great way to add an element of automation in operation to expedite the order fulfilment process. Simply put, conveyors move products from point A to point B. There are many options to accommodate what needs to happen in between point A and point B within conveyor types. The conveyor is used to get products from the racking system quickly over to fulfilment to be packed and shipped. This way, a forklift driver doesn't have to travel the farther distance from the racking to the packing area.

INTEXT QUESTIONS 25.3

1. Give the advantages of semi-automated Material handling?

2. semi-automated element into the picking and placing process has been shown to provide up to _____ pick and place accuracy

   a. 99.6% b. 100% c. 98% d. 97.9%

25.4 AUTOMATED MATERIAL HANDLING SYSTEMS

Automated material handling systems are pre-programmed computerised systems with built-in technology for task completion. These systems feature advanced technology for material movement, storage, access, and location. Automated material handling may require manual interference for tasks such as picking, dropping, and pushing. Some examples of automated handling equipment include scissor lifts, dock levellers, pallet positioners, and automatic conveyors.

Automated systems are faster, more agile, and easily scalable. It can be adapted to carry out more than one task with careful planning and research. Automated systems require a substantial initial investment. The cost may go up further if it is a customised system. However, can compensate for these increased costs by saving on manual labour and increased productivity and order fulfilment precision. Automated systems can help optimise the warehouse and storage space as they allow you to utilise the vertical ceiling clearances.Automated systems require operators with technical skills. They also need to undergo the necessary training to operate the lifting and handling equipment. Automated systems, on the other hand, are suitable for repetitive or predictable order fulfilment processes.

A. Automated Material Handling Merits

a. Increased Flexibility – Automated systems are flexible. If you are scaling your operations, then you can program these systems accordingly to handle more than

one process at a time. With proper planning, you can use automated systems to scale up or downsize in real-time.

b. **High Cost-Efficiency** – Automated systems save money in the long run. The technology may be expensive, especially if it is a customised product. But the cost can be compensated because manual labour is reduced. With automation, tasks can be performed faster and with precision, which increases productivity.

c. **Enhanced Workplace Safety –**With automated handling, employees will not have to lift or carry around heavy weights, which reduces the risk of trip-and-fall accidents. Risks of physical problems such as lower back pain, back injuries and fatigue, are also minimised.

d. **Space Optimization** – Space can be used with maximum efficiency. For example, automated equipment such as forks enables access to spaces located higher. This space can be used to stack products without wastage. Products can also be retrieved faster and with ease through the use of automated handling systems. Existing space is used to create more space and is used efficiently.

e. **Enhanced Order Fulfilment and Delivery** – Automated handling minimises errors in order handling, improves shipping process, and quickens delivery. As a result, customer service has improved.

f. **Better Employee Morale** – Employees with technical expertise will show interest in your business. A workstation that protects employees from accidents and injuries is an attractive draw for employees experienced in material handling and logistics. It leads to retaining existing employees and attracting new employees.

B. Automated Material Handling Demerits

a. **Initial cost of equipment:** Automated equipment is more expensive up front than manual equipment. However, whatever saved in man power and gained in increased productivity, means the equipment will eventually pay for itself and then some.

b. **Reduced flexibility for change:** Once automated systems are in place, it is likely not as easy to make changes in the workspace. But once automated and see how smoothly everything runs, it's not likely all will return to manual equipment afterwards.

c. **Possible downtime due to malfunction:** With automatic machines there is always the chance of a problem or breakdown, which can lead to considerable downtime while it is repaired. If the problem cannot be fixed by anyone on site, an outside specialist may need to be called, which could mean more time spent waiting.

d. **Maintenance costs:** Some automated equipment needs maintenance. Routine maintenance may be performed regularly by onsite workers, but periodic professional

maintenance should be handled by specialists who are trained to inspect and tune-up machinery so that it runs smoothly and efficiently. Then I have to depend on them periodically.

INTEXT QUESTIONS 25.4

1. What is automated MHS
2. With automation, tasks are performed faster and with precision, which increases __

   a. productivity b. safety

   c. morale d. order fulfilment

WHAT HAVE YOU LEARNT

MMH: Process of handling or moving materials using manual labour. MMH includes pushing, pulling, lifting, retrieving, controlling, carrying, and holding. Though manual, this type of handling requires the use of equipment such as manual cranes, pallet trucks, slings and hooks, short-distance conveyors, and forklifts.

Semi-automated material handling: Are a great alternative to full warehouse automation. Semi-automated systems will allow maintaining competitiveness without investing as much as for full automation. Semi-automation is a system that utilises automated machinery with human labour and intervention. So, the machine exists to *enhance* the processes that employees are performing.

AMH : Refers to any automation that reduces or eliminates the need for humans to check-in, check-out, sort material, or to move totes and bins containing library material.

KEY TERMS

Warehouse	logistics	raw materials	works in process
completed products	cargo	Material handling device	movement
packing	unpacking	storage	protection

TERMINAL EXERCISE

1. Expand MHS.
2. What is material handling?
3. What is manual material handling?
4. What is semi-automated handling?
5. What is an automated warehouse?
6. What are the types of MHE?
7. List a few manual handling equipment.
8. Give the demerits of manual MH.
9. State the merits of automated MH.
10. Mention the industries that use automation in MH.
11. Briefly explain the merits and demerits of MMHS.
12. Briefly explain the merits and demerits of Semi-automatedMHS.
13. Briefly explain the merits and demerits of AMHS.

ANSWERS TO INTEXT QUESTIONS

25.1

1. Various types of material handling systems are MMHS, SAMHS and AMHS

2. d.

25.2

1. Hooks, slings and manual cranes 2. Cost saving 3. a.

25.3

1. Flexibility and room to grow, Allows for human intervention and Faster return on Investment

2. a.

25.4

1. Automated materials handling (AMH) refers to any automation that reduces or eliminates the need for humans to check-in, check-out, sort material, or to move totes and bins containing library material.

2. a.

DO AND LEARN

The students could have used automated devices in their house. They could discuss the utility of the devices used by them in terms of benefits they attained and how they further decide on the use of such automated appliances in future.

ROLE PLAY

Aravind and Baskar are the two friends who do trading activities in their towns. Aravind employs more labourers for his work but Baskar always uses semi automated and automated devices with minimum employees. They now start discussing the merits and demerits about their methods.

Aravind: Hello Baskar how are you and how is your work going?

Baskar: Fine Aravind. I want to discuss with you the use of equipments at work spot as I feel difficult to get enough number of labors every time and find difficult to manage with them

Aravind: Oh… I will explain to you the use of simple and cost effective equipment that can be used effectively?

Baskar: Thanks, tell me now the details.

Continue the conversation in your own way to convince Aravind on the use of equipments