26

# TECHNOLOGY FOR WEREHOUSE MANAGEMENT

A warehouse management system (WMS) is defined as software designed to manage the movement of inventory to know where final products and goods are at any time to fulfil orders. The purpose of a warehouse management system is to help organisations have an efficient warehouse by determining the best arrangement for storage and workflow. It tracks all forms of inventory so items can be quickly located and it helps to manage the supply chain by keeping track of what is needed and when. It supports the use of RFID tags, barcoding, and serial numbers. WMS software can even eliminate the need for periodic manual inventory counts. A Warehouse Management System (WMS) is a software application that supports the day-to-day operations in a warehouse and is a key part of the modern supply chain process. WMS programs enable centralised management of tasks such as tracking inventory levels, receiving, picking, put-away and identifying stock locations.

A WMS monitors the progress of products through the warehouse. It involves the physical warehouse infrastructure, tracking systems, and communication between product stations. More precisely, warehouse management involves the receipt, storage and movement of goods to distribution centres or to a final customer. Early warehouse management systems could only provide simple storage location functionality. Current WMS applications can be so complex and data intensive that they require a dedicated staff to run them. High-end systems may include tracking and routing technologies such as Radio Frequency Identification (RFID) and voice recognition. No matter how simple or complex the application is, the goal of a warehouse management system remains the same — to provide management with the information it needs to efficiently control the movement of materials within a warehouse.WMS software improves warehouse processes by providing organised methods for various warehouse activities that helps to reduce errors and improve employee satisfaction. With automated processes and greater communication,

a warehouse management system decreases costs, improves productivity, and enhances service.


*Fig. 26.1:* **Warehouse Management System**

## LEARNING OUTCOMES

After studying this lesson the learner:

- discusses warehouse automation and its process;
- summarizes the benefits and challenges of warehouse automation;
- classifies warehouse automation trends and costs;
- assesses the warehouse automation implementation with software.

## 26.1 WAREHOUSE AUTOMATION

Warehouse automation is the process of automating the movement of inventory into, within, and out of warehouses to customers with minimal human assistance. As part of an automation project, a business can eliminate labour-intensive duties that involve repetitive

physical work and manual data entry and analysis. For example, a warehouse worker may load an autonomous mobile robot with heavy packages. The robot moves the inventory from one end of the warehouse to the shipping zone and software records the movement of that inventory, keeping all records current. These robots improve the efficiency, speed, reliability and accuracy of this task. But warehouse automation does not require physical or robotic automation, and in many cases simply refers to the use of software to replace manual tasks.

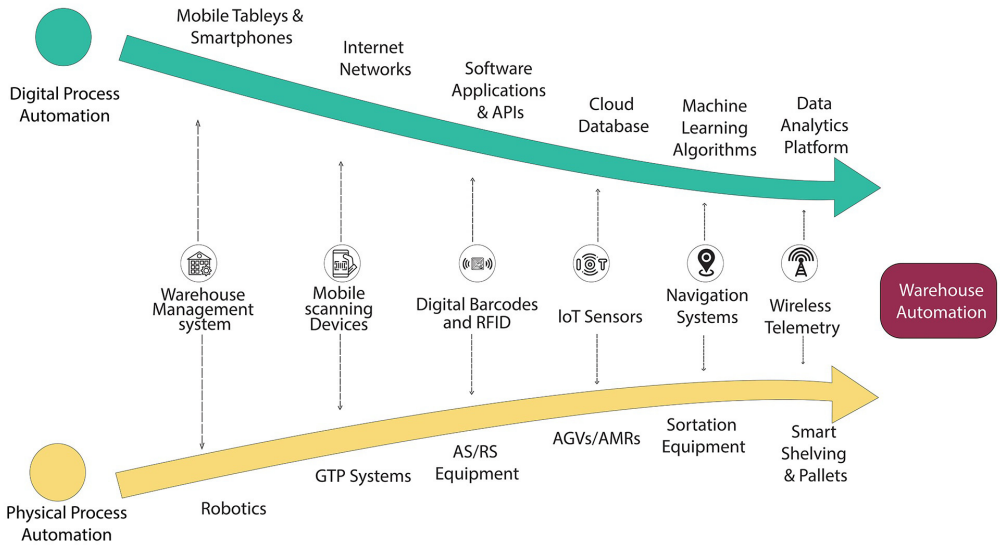



***Fig. 26.2:*** **Warehouse Automation**

However, this scenario illustrates how robots and humans work together to accomplish repetitive tasks while minimising fatigue and injury.

### 26.1.1 Digital Automation

Digital automation uses data and software to reduce manual workflows. Automatic identification and data capture (AIDC) technology, like mobile barcoding, is an example of digital automation in the warehouse. The benefits of digital process automation include the ability to integrate with enterprise resource planning (ERP) systems, enhanced security, greater data management efficiency, reduced operational and legal risks, and improved safety—but from the warehouse perspective, it reduces manual processes and eliminates human errors. AIDC technology like radio frequency identification (RFID) and mobile barcode scanning can enhance the worker experience, improve customer service and reduce operational costs associated with human error. Implementing digital automation technology requires a significant upfront investment. These costs include hardware, software and support contracts and the time and resources required to implement the systems and



train employees. In addition, digital automation can increase the risk of lost or corrupted data and cybersecurity threats.

### 26.1.2 Physical Automation in the Warehouse

Physical automation is a way to use technology to minimise employee movement and build more efficient workflows. Robots are one example of how it works in the warehouse. The advantages of physical automation include increased warehouse capacity and efficiency, enhanced reliability and scalability of services and improved performance. The downsides are the significant upfront expenses, the scarcity of a skilled workforce to manage and maintain the system, high maintenance costs and equipment that is meant for highly-specific functions. To take advantage of automated warehouse systems, businesses need advanced planning and organisation. These systems are more suited for large-volume warehouses and distribution centres with space to accommodate specialised equipment.

### 26.1.3 Categories of Warehouse Automation

Warehouse automation varies from relatively simple to quite complex. Basic automation uses planning, machinery and vehicles to reduce repetitive tasks. Advanced systems take advantage of artificial intelligence and robotics. Warehouse automation categories include:

A. **Basic Warehouse Automation:** This type of automation refers to simple technology that assists people with tasks that would otherwise require more manual labour. For example, a conveyor or carousel moves inventory from point A to point B.

B. **Warehouse System Automation:** This type of system uses software, machine learning, robotics and data analytics to automate tasks and procedures. For example, a warehouse management system reviews all the orders that need to be filled in a day and has users pick items to fulfil all those orders at once so they don't traverse the warehouse back and forth multiple times.

C. **Mechanised Warehouse Automation:** This kind of warehouse automation uses robotic equipment and systems to assist humans with warehouse tasks and procedures. Autonomous mobile shelf loader robots that lift racks of products and deliver them to human pickers to retrieve and sort is one example.

D. **Advanced Warehouse Automation:** Advanced warehouse automation combines mechanised warehouse robotics and automation systems that can replace labour-intensive human workflows. For example, a robotic forklift fleet that uses advanced AI, cameras and sensors to navigate a warehouse and communicate each forklift's location to an online tracking portal.



### 26.1.4 Types of Warehouse Automation Technology

There are many types of warehouse automation because there is a wide range of warehouse technology and systems available. Warehouse automation aims to minimise manual tasks and speed up processes, from receiving to shipping. Warehouse automation technology includes:

A. **Goods-to-Person (GTP):** Goods-to-person fulfilment is one of the most popular methods for increasing efficiency and reducing congestion. This category includes conveyors, carousels and vertical lift systems. When properly applied, GTP systems can double or triple the speed of warehouse picking.

B. **Automated Storage and Retrieval Systems (AS/RS):** AS/RS are a form of GTP fulfilment technology that includes automated systems and equipment like material-carrying vehicles, tote shuttles and mini-loaders to store and retrieve materials or products. High-volume warehouse applications with space constraints tend to utilise AS/RS systems.

C. **Automatic Guided Vehicles (AGVs):** This class of mechanised automation has minimal onboard computing power. These vehicles use magnetic strips, wires or sensors to navigate a fixed path through the warehouse. AGVs are limited to large, simple warehouse environments designed with this navigation layout. Complex warehouses with lots of human traffic and space constraints are not good candidates for AGVs.

D. **Autonomous Mobile Robots (AMRs):** More flexible than AGVs, AMRs use GPS systems to create effective routes through a specific warehouse. They use advanced laser guidance systems to detect obstacles, so AMRs can safely navigate dynamic environments with lots of human traffic. They are easy to program with routes and easy to implement quickly.

E. **Pick-to-Light and Put-to-Light Systems:** These systems use mobile barcode scanning devices synced to digital light displays to direct warehouse pickers where to place or pick up selected items. They can dramatically reduce walking and searching time and human error in high-volume situations.

F. **Voice Picking and Tasking:** The use of voice-directed warehouse procedures, also known as pick-by-voice, uses speech recognition software and mobile headsets. The system creates optimised pick paths to direct warehouse workers where to pick or put away a product. This method eliminates the need for handheld devices like RF scanners, so pickers can concentrate on their task with improved safety and efficiency.

**G. Automated Sortation Systems:** Sortation is the process of identifying items on a conveyor system and diverting them to a warehouse location using RFID, barcode scanners and sensors. Companies use automated sortation systems in order fulfilment for receiving, picking, packing and shipping.

## INTEXT QUESTIONS 26.1

1. Define warehouse management system
2. What is warehouse automation
3. Warehouse automation works by using software and technology like _____ to automate tasks.

   a. robotics and sensors

   b. inventory and storage

   c. receiving and shipping

   d. None

## 26.2 WAREHOUSE AUTOMATION PROCESS

Warehouse automation works by using software and technology like robotics and sensors to automate tasks. These products work in concert with existing tools like inventory management software. Warehouse automation helps ensure that business-critical operations meet customer demand. It starts with a warehouse management system (WMS) that automates manual processes and data capture, inventory control and supports data analysis. These systems integrate with other solutions to efficiently manage and automate tasks across different business and supply chain functions.

### 26.2.1. Five Steps to Automate Warehouse

Five-step plan to get started with warehouse automation.

**A. Create an implementation committee.**

Form a committee of internal stakeholders who have expertise on current warehouse performance, capabilities and challenges, and understand existing technology gaps. Consider adding third-party experts who know about supply chain automation and have experience relative to industry and warehouse operations.

### B. Collect critical data.

Successful warehouse automation relies on data about existing supply chain and business-critical warehouse operations. Before implementing new automation technology, evaluate the current data collection process and infrastructure. You'll want to assign ownership of data migration to skilled IT stakeholders.

### C. Evaluate inventory controls.

Inventory control is at the core of warehouse operations. Before implementing a warehouse automation solution, determine or refine standard operating procedures (SOPs) for inventory control. Include SOPs for purchasing, shipping, receiving, customer satisfaction and inventory loss. Define the key performance indicators (KPIs) to measure the success of automated inventory control processes and procedures. Evaluate the inventory accounting method currently in place (for example, periodic or perpetual systems) and determine how automation will impact it. Read the guide about inventory control to learn more.

### D. Implement a warehouse management system (WMS)

WMS platforms feature software modules that help control and track inventory, manage warehouse operations, reduce labour costs associated with manual tasks, and improve customer service. A modern WMS supports mobile devices and should be able to work with existing enterprise software.

### E. Determine what kind of warehouse automation you want

Is the goal to use automation to streamline manual data entry and reduce labour costs associated with back-office warehouse operations and accounting? Or, are you expanding warehouse footprint or adding locations and think it's time to use advanced physical process automation like robots and GTP systems? Determining the type of warehouse automation that aligns with goals and customer demand is essential.

## 26.2.2 Warehouse Processes that Can Be Automated

The right warehouse automation technology can automate tasks that touch every aspect of order fulfilment and inventory control, including:

A. **Receiving:** You can use mobile devices to quickly capture data in warehouse receiving area. Integrated software captures, processes and stores data that impacts downstream and upstream automated workflows.

B. **Returns:** Automated sorting systems and equipment like conveyors can automate

return processing procedures. Use them to sort products to return-to-stock shelves or put away in designated storage locations.


*Fig. 26.3:* **Warehouse Process automation**

C. **Putaway:** Putaway refers to the act of moving products from receiving to storage. Automating this process can also help facilitate cross-docking, where goods are rapidly sorted, processed and placed onto trucks bound for different destinations instead of being stored in the warehouse.

D. **Picking:** Manual order picking is the costliest warehouse activity—warehouse travel time can consume as much as 50% percent of working hours. Using GTP systems and autonomous mobile robots can rapidly increase the speed and efficiency of moving inventory from stock locations to fill customer orders.

E. **Sorting:** Sorting and consolidating warehouse inventory is a time-consuming, often confusing task. Automated sortation and AS/RS systems improve inventory accuracy and quality control by recognizing and handling small or fragile inventory separately.

F. **Replenishment:** Automated inventory tracking and cycle counting empower automated reorders. When an inventory item reaches a designated par level, the system automatically triggers an order request and flags it for approval. Automated replenishment can help prevent overstocking costs and inventory loss due to spoilage and theft.



**G. Packaging:** Automated packaging and cartonization systems use algorithms to determine the best type of shipping packaging based on product attributes (like durability), dimensions and material costs.

**H. Shipping:** Automated shipping systems uses conveyors, scales, dimension sensors, printers and software applications to determine available carriers, estimate shipping rates and apply labels to packages for shipment.

## INTEXT QUESTIONS 26.2

1. Automating process of a warehouse requires initially a _____

   a. project plan

   b. packaging

   c. replenishment

   d. sorting

2. Why Should You Automate a Warehouse?

## 26.3. BENEFITS OF WAREHOUSE AUTOMATION

Using automation to improve warehouse operations brings a wide range of advantages, from running more efficiently to minimising human error. Here's a list of the most commonly cited benefits:

- Increased warehouse throughput
- Better resource utilisation
- Reduced labour and operational costs
- Improved customer service
- Reduced handling and storage costs
- Reduced human error
- Minimised manual labour
- Increased productivity and efficiency
- Improved employee satisfaction
- Enhanced data accuracy and analysis
- Reduced stock out events
- Optimised warehouse space
- Greater inventory control
- Improved workplace safety
- Fewer shipping errors
- Reduced inventory loss
- Enhanced material handling coordination
- Improved order fulfilment accuracy

### 26.3.1 Challenges of Warehouse Automation

Despite the benefits related to warehouse automation, it also has some challenges. It requires significant capital to get up and running and expertise to establish and maintain the system, which many companies don't have in-house and can be difficult to find. Additionally, equipment can break down, often at the worst of times, leading to downtime and repair/maintenance costs.

To minimise maintenance issues, set up maintenance schedules. The high upfront costs for equipment and setup typically pay for themselves over time through efficiencies and increased sales, but businesses need to carefully anticipate and mitigate some challenges with proper risk assessment and planning. The planning phase should include regular inventory audits to verify the accuracy of new data from automated processing against existing records.

### 26.3.2 Examples of Warehouse Automation

The popularity and growth of ecommerce has increased the demand for warehouse automation. Here are some examples of how it works across various industries:

A. **Barcode Scanning:** Amazon uses automated barcode scanning and labels to dominate online retail and optimise warehouse operations. This automation is responsible for Amazon's famously innovative storage system. Unique barcodes are placed on incoming products and on the shelves where they reside. When it's time to ship a product, employees use the updated picking list to find the product location based on automated routes optimised for efficiency and flow.

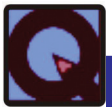
B. **Picking Automation with GTP Systems:** Nike implemented a GTP picking system in its new distribution centre in Japan. The automated GTP picking system uses autonomous robots to carry products and packages loaded on shelves or pallets directly to warehouse workers for order fulfilment. The new warehouse automation helped transform logistics and enable Nike to provide same-day delivery to customers in Japan.

C. **Inventory Automation with AS/RS Systems:** IKEA operates highly automated warehouse facilities worldwide. Its distribution centres feature AS/RS inventory automation systems and equipment, including 100-foot-tall trilateral stacker cranes and conveyor rack systems capable of automatically transferring 600 pallets an hour to dispatch areas.

D. **Back-Office Automation:** WMS platforms with digital process automation features can optimise back-office operations. Automation, a distributor of machine control



solutions and services to OEM machine builders, had siloed applications that slowed productivity, as staff had to manually import and export data across multiple systems to support sales and customer service teams. The company implemented NetSuite's Inventory Management, CRM and Manufacturing Execution System to enhance back-office sales and customer support functions with automated barcoding, case management and issue tracking solutions.



## INTEXT QUESTIONS 26.3

1. List any three benefits of warehouse automation
2. Give the major challenge in warehouse automation
3. Warehouse automation systems chosen should integrate with a ____ platform.

   a. WMS  b. Cycle count

   c. Supply chain  d. inventory

## 26.4 WAREHOUSE AUTOMATION TRENDS AND COSTS

### A. Warehouse Automation Trends

Warehouse automation will help address insufficient warehouse space, inefficient inventory operations and labour shortages. Online retail sales of physical goods are expected to approach $500 billion dollars, increasing warehouse services demand.More than 90% of warehouse operators report that cost-cutting measures are critical to successfully balance the need for more space and services and the difficulty of hiring and retaining a qualified workforce to meet demand. Failing to plan for these trends may cost more than the expenses associated with warehouse automation.

Here's a list of the digital and physical warehouse automation and robotics trends empowering the modern warehouse:

**a. Robotics:** The investment in warehouse robotics startups increased by 57% in the first quarter of 2020 to more than $380 million. The trend will continue to see momentum in a post-pandemic economy and areas with workforce shortages, like Japan.

**b. Cobotics:** Cobotics refers to a collaboration between person and robot (cooperation and robotics forms cobotics). Cobots, designed to work with people, do not replace human tasks. Cobots in warehouse automation include AMRs that can scan their environment. This cabot AMR can avoid collisions with humans and human-operated

machinery by recognizing changes in its 360-degree field of vision and can safely drive backward when necessary.

c. **Supply Chain as a Service:** Warehouse service-based markets are growing to fill the demand for flexible warehouse operations and automated technology like autonomous robots. Companies offering subscription-based, full-service automated warehouse solutions seek to replace manufacturers and service providers that offer automated equipment and system sales.

d. **Blockchain Technology:** Blockchain technology has implications for warehouse operations and inventory management because of its advanced data authentication, validation and transparency. Blockchain databases could allow every stakeholder in complex supply chains to connect and share permanent, automated records for every transaction made, with shared data storage accessible to everyone within the secure network.

e. **Warehouse Drones:** Intelligent drone fleets powered by advanced algorithms and connected to cloud-based WMS can help manage inventory inside warehouses. Some warehouse drones are equipped with visual sensors or barcode scanners to track inventory and automate procedures like cycle counting.

f. **Fast Shipping:** The "Amazon effect" of one- or two-day shipping has created intense demand for rapid online shipments regardless of who sells the product. Same-day shipping will continue to drive warehouse automation that speeds up order fulfilment tasks like picking and improves the accuracy and cost-effectiveness of automated packaging and shipping procedures.

g. **Warehouse Cleaning:** There is already a market for automated industrial-sized robotic floor cleaners that navigate complex warehouse layouts. Now, a new class of automated mobile cleaning robots is emerging to safely sanitise and disinfect high-touch indoor workplaces like warehouses and distribution centres with UV lights and sanitising chemicals.

h. **Mobile Shelving:** Amazon is the most famous example of companies using GTP systems powered by AGVs and AGRs. The autonomous robot fleets can load and transport mobile shelving units with stored inventory to designated locations. This enables workers to pick orders with minimal movement and walking time.

i. **Autonomous Vehicles:** Autonomous robotic forklifts are already in use at automated warehouse and distribution centres. Autonomous vehicles are expected to move further up the supply chain to include automated delivery trucks that transport inventory between warehouses, manufacturers and retail locations.

j. **ERP Integrations:** API technology and machine learning (ML) are empowering automation systems that integrate with ERP suites to create an end-to-end automated business platform. Further improvements in automation and ERP applications will free up back-office workforces to perform more value-added, creative and customer-focused tasks.

k. **Big Data:** The move toward cloud-based applications and databases capable of collecting, processing and storing large datasets that are easily accessible will drive data analytics around warehouse operations further.

l. **IoT:** Although not strictly an emerging technology, RFID sensors continue to be a driver for new IoT applications that streamline supply chains and warehouse operations. IoT expands warehouse visibility by providing location data on equipment and inventory in real time. The mobility, affordability and real-time inventory tracking capability of RFID sensors provide enhanced data collection capabilities across systems.

m. **Wireless Fleet Management:** Innovations in IoT applications, cloud databases and sensor technology has created the ability to manage automated fleet vehicles wirelessly. Onboard computers communicate telemetry to the system with detailed information about equipment location, maintenance schedules and accident alerts.

### 26.4.1. Cost to Automate Warehouse

The cost of warehouse automation varies depending on the level and type of automation. To determine if warehouse automation is right for business, start by calculating estimated ROI. Estimate the budget for current warehouse labour and existing equipment and include any expected annual increases. Next, calculate average turnover rate for warehouse employees and factor in the cost of hiring and training new employees. Now, determine the purchase cost of the new automated systems and equipment, and factor in estimated labour and cost savings, training and implementation costs and ongoing maintenance expenses. Finally, compare these figures to determine the estimated minimum ROI for warehouse automation.

## INTEXT QUESTION 26.4

1. What do modern warehouses focus on?
2. _____ factor determine the cost of warehouse automation

   a. Estimated ROI  b. Cash flow

   c. Delivery capacity  d. All these

3. What is the role of warehouse drones?

## 26.5. IMPLEMENTING WAREHOUSE AUTOMATION WITH SOFTWARE

Warehouse automation using inventory tracking and warehouse management systems has tremendous potential and will be crucial to the evolution of modern warehouse management. Moving products from one place to another with as little human contact as possible helps create supply chains capable of rapid, seamless order fulfilment. Investing in these machines and advanced devices will help companies continue to meet customer expectations that seem to grow by the day.

### 26.5.1 Barcode systems

A barcode system is a collection of tools that allow for the electronic transfer of data related to inventory's various products. Tools involved in a typical barcode system include:

- Handheld scanners
- Mobile apps
- Web apps
- Printers
- Intranet servers

**A. Laser barcode scanners** are the most well-known type of barcode scanner by today's standards. This type relies on a red diode to read the black and white markings on a label in either a linear or omnidirectional pattern; those that support omnidirectional scanning have a wider reading area, and are therefore easier to use than their linear counterpart.

**B. Linear imaging barcode scanners** only read 1D barcodes. Instead of using a laser, image barcode scanners use image capture technology to scan barcodes and digital image processing functionality to decode them.

**C. 2D barcode scanners** work like linear imagers except that they can read stacked and 2D barcodes. They also scan barcodes in any direction.

### 26.5.2 RFID (radio frequency identification)

Radio Frequency Identification (RFID) is an automated data collection technology that enables equipment to read tags attached to the objects without contact or line of sight. RFID uses radio frequency (RF) waves to transfer data between a reader and an item to identify, track or locate the item. The RFID system consists of a tag, which is made up of a microchip with a coiled antenna, and an interrogator or reader with an antenna. The

reader sends out electromagnetic waves that form a magnetic field when they "couple" with the antenna on the RFID tag. A passive RFID tag draws power from this magnetic field and uses it to power the microchip's circuits. The chip then modulates the waves that the tag sends back to the reader and the reader converts the new waves into digital data and sends them to a server for processing.

In a warehouse when a material is received, the RFID reader can read the contents in the RFID tag attached to the LPN and record a receipt automatically. Similarly, during the outbound shipment process, the RFID reader can read the contents in the RFID tag attached to the LPN and automatically confirm the shipment. This eliminates the task of manual confirmation of receipt and shipment. Using RFID scanning, microchips are placed on or within inventory. These microchips, or tags, include any and all necessary data about the product in question (in a similar fashion to traditional barcodes). That information is then transmitted via radio frequency to an RFID scanning device, allowing warehouse teams to easily keep track of individual products.RFID scanners can scan multiple items simultaneously, in contrast, barcode-tagged items need to be manually scanned one at a time. There are, of course, a few downsides to using RFID:

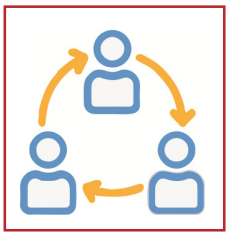
- The need to update scanning equipment throughout warehouse(s)
- The need to maintain the additional data held within the RFID tags
- The monetary and resource-related cost of the above processes

### 26.5.3 ERP Software

ERP (enterprise resource planning software) is a suite of business management solutions with multiple modules to manage every area of the organisation. Most ERP systems include a Warehouse Management System module. The main advantage of using an ERP-based WMS tool is that you'll easily be able to integrate and sync data between *all* tools within the suite. This will ensure that all information presented within any of these platforms is accurate, up to date, and consistent across the board.

Having WMS integrated with ERP system provides additional business benefits that include:

#### Improved Visibility and Collaboration



Having all data and workflows housed and orchestrated in one system that is shared across the organisation increases visibility throughout the company. It also integrates manufacturing and warehouse operations with core business functions like financials, customer service, logistics, and it improves coordination and collaboration.

## Increased Accuracy

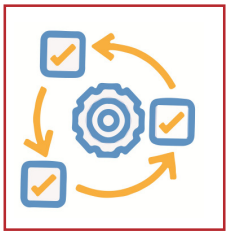
Eliminate manual entry and errors from data having to be re-entered because it is housed in one system of record and source of truth that other business functions and departments can access and share, avoiding the need for redundant data entry.

## Better Decision Making

Real-time information from the warehouse provides insight into what is happening with inventory movement, customer orders, and overall scheduling and planning across the organisation to help make informed decisions.

## Smarter Sales and Customer Service

Provides the sales team with information on what is in stock and the lead times needed. It equips the customer service team with real-time status on customer orders and delivery timing so business can make promises it can deliver upon.



## Greater Agility

With a modern ERP system that is connected across the company, all departments are in sync and it is simpler to adjust business processes as needed when critical information is easily accessed and shared.

## Faster Billing

Having shipment information processed immediately and sent to accounting allows for invoices to be sent quicker and payments to be received faster.

## Track Productivity

With instant notification about where employees are with jobs, managers can ensure things are kept moving and they can track how well staff are performing

### 26.5.4 Electronic Data Transfer

Electronic Data Transfer can significantly reduce the processing time for goods acceptance documentation. Companies that have implemented and integrated EDI in their warehouse business processes realised a reduction in processing time of up to 90%.Moreover, with large volumes of deliveries, there are other advantages of electronic data Interchange. This type of system/approach will be most powerful choice and provides a more complete business management solution that integrates accounting and financials, customer relationship management, inventory management, and more. If you want to better connect all aspects of business, streamline end-to-end processes, and see the benefit of growing and increasing competitiveness with a single solution and source of data, this is a good solution.

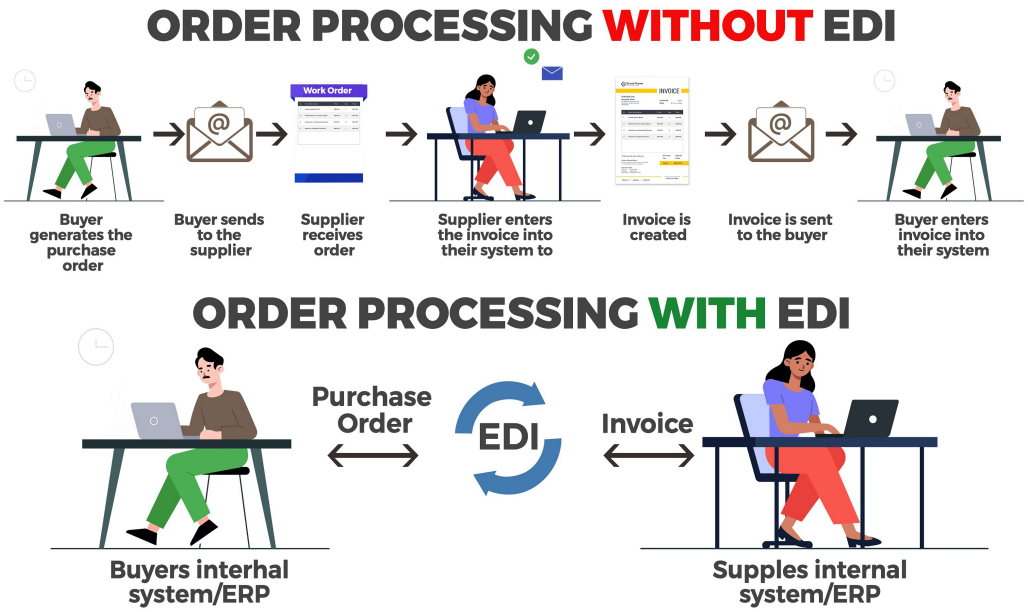



*Fig. 26.4:* **EDI solutions**

The first processes that EDI solutions addressed were the order-to-cash and the procure-to-pay cycles. EDI payment documents and EDI invoices help remove human intervention, thereby reducing errors in these key business documents. EDI transactions now happen automatically—flowing from the accounts receivable systems of the supplier to the accounts payable systems of the buyer in a matter of moments. Where there were errors, these could be quickly identified and addressed. The entire process of an EDI transaction can take minutes or maybe hours compared to days or weeks for the paper-based equivalent.

## Benefits of EDI

**A. Improve customer experience:** Through streamlined orders and purchasing EDI improves order accuracy and transparency, which allows for more increased communication with customers that provides them accurate information on their transactions with the business. This in turn can greatly improve customer experience and loyalty as there's no guesswork or confusion.

**B. Speed Processing:** EDI enables speed and improves overall movement throughout a business because timely processes have become much quicker and streamlined. This can bring about new opportunities for both the business and trading partner as it can introduce opportunities for buyer discounts and innovative finance options of the supplier.

**C. Reduce errors:** EDI standardised transactions with suppliers reducing the risk of miscommunication, human error, incorrect shipments and other mistakes. This can be especially helpful for large retailers as they deal with a large variety of suppliers within their operations.

**D. Save time and money:** Inherent in all of the mentioned benefits is the fact that all of these factors help businesses save time on tedious processes, and save money by moving paper transactions to digital mediums. By switching to EDI in business processes like ordering and purchasing are sped up. Costly expenses for storage are minimised, while costs for communications and manual checks are reduced due to streamlining and improving processes through the EDI system.

**E. Improve inventory management:** EDI documents and transactions both provide a great deal of transparency for businesses and trading partners, allowing for improvements across the board for warehouse management. By exchanging EDI documents, high levels of supply chain visibility provides real-time updates for businesses so inventory levels are much more accurate. This gives businesses the ability to effectively allocate resources and prevent inventory shortages while also giving them the capabilities to eliminate excess inventory.

## INTEXT QUESTIONS 26.5

1. Linear imaging barcode scanners only read _____ barcodes

   a. 1D  b. 2D

   c. 3D  d. All these

2. How EDI improves the efficiency of warehouse

3. Define RFID



## WHAT YOU HAVE LEARNT

| | |
|---|---|
| **Warehouse management system:** | Software designed to manage the movement of inventory to know where final products and goods are at any time to fulfil orders |
| **Warehouse automation** | Process of automating the movement of inventory into, within, and out of warehouses to customers with minimal human assistance |
| **Digital automation** | Uses data and software to reduce manual workflows |
| **Physical automation** | Use technology to minimise employee movement and build more efficient workflows. |
| **Warehouse process automation** | Leads to more cost-effective operations and reduces product handling costs |
| **Barcode system** | Collection of tools that allow for the electronic transfer of data related to inventory's various products |
| **Radio Frequency Identification** | Automated data collection technology that enables equipment to read tags attached to the objects without contact or line of sight. |
| **Enterprise resource planning** | Suite of business management solutions with multiple modules to manage every area of the organisation |
| **Electronic Data Transfer** | Significantly reduce the processing time for goods acceptance documentation |

## KEY WORDS

| | | |
|---|---|---|
| Warehouse management | Warehouse Automation | Digital Automation |
| Physical Automation | Bar code | RFID |
| Scanning Devices | ERP | EDI |

## TERMINAL EXERCISE

1. Define warehouse automation
2. What is digital automation
3. What is physical automation
4. What is robotics
5. Give the types of barcode
6. Explain the block chain technology in warehouse automation
7. List the Tools involved in a typical barcode system
8. Give the major benefits of EDI
9. What are the uses of scanning devices
10. What is wireless fleet management
11. Explain the RFID
12. Discuss the warehouse automation process
13. Discuss the benefits of WMS integrated with ERP
14. Describe the Types of Warehouse Automation Technology
15. Brief about the Categories of Warehouse Automation

## ANSWERS TO INTEXT QUESTIONS

### 26.1

1. A warehouse management system (WMS) is defined as software designed to manage the movement of inventory to know where final products and goods are at any time to fulfil orders.
2. Warehouse automation is the process of automating the movement of inventory into, within, and out of warehouses to customers with minimal human assistance.
3. Choice a.

### 26.2

1. Choice a.
2. An inefficient warehouse negatively impacts the customer experience. Automated warehouses do more with less and thrive under increased customer demand.

### 26.3

1. Benefits of WA - Better resource utilisation, Reduced labour and operational costs and Improved customer service
2. Major challenges areWA requires significant capital to get up and running and expertise to establish and maintain the system, which many companies don't have in-house and can be difficult to find. Additionally, equipment can break down, often at the worst of times, leading to downtime and repair/maintenance costs.
3. Choice a.

### 26.4

1. Modern warehouses focus less on traditional storage roles and more on value-added services, order customization and rapid flow-through processes that stage products according to just-in-time inventory principles.
2. Choice d.
3. Intelligent drone fleets powered by advanced algorithms and connected to cloud-based WMS can help manage inventory inside warehouses.

## 26.5

1. Choice a.

2. Companies that have implemented and integrated EDI in their warehouse business processes realised a reduction in processing time of up to 90%. This provides a more complete business management solution that integrates accounting and financials, customer relationship management, inventory management, and more.

3. Radio Frequency Identification (RFID) is an automated data collection technology that enables equipment to read tags attached to the objects without contact or line of sight.

## DO AND LEARN

Take the examples of agriculture goods and electronic goods that need the warehouse automation process. Make two groups of class and find out how the warehouse operations like physical and digital are performed in the warehouse for the two types of goods selected. Find the difference inefficiency and costs involved

## ROLE PLAY

A warehouse management system (WMS) consists of software and processes that allow organisations to control and administer warehouse operations from the time goods or materials enter a warehouse until they move out. A renowned private retailer Shivaram and a software provider Vivek discuss the warehouse management system using software to fulfil the needs of Shivaram's retail business where he deals with FMCG goods.

Form two groups and initiate the role play of Shivaram and Vivek further to discuss the pros and cons of such a system.