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## The impact of technology on the evolution of warehouse management and smart warehouses

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### ABSTRACT

*The article focuses on the evolution of warehouse management and how technology has played its part in this process. The concept of smart warehouses is discussed along with various technologies that different companies can implement in their warehouses. Through this article, we have tried to show how various problems such as costs, wastage of goods and time are reduced and a sustainable supply chain is created as a result of automated warehouses ensuring eco-friendly warehouses across the world.*

**Keywords**— Smart warehouse, Technologies, Inventory management, Robots, Warehouse

### 1. INTRODUCTION

In the 19th century, the use of railways to transport goods over long distances increased. Railway companies often monopolize the storage and transportation of these goods. All transportation and lifting after arriving at the railway terminal is done by hand. In the late 1990s, the use of trolleys made mobile products easier. Products are often unclassified and are susceptible to inaccurate delivery. The product stacks up to 12 feet, but leaves a small amount of space for the different products in each stack and makes it difficult to track the exact amount of inventory.

The difference between the past warehouse and today's warehouse is clear. Prior to the 20th century, warehouse management included manual processes written on paper. With the advent of new technologies and new ideas, warehouse management has evolved into a more automated process. Today, the main focus of warehouse management is managing the movement and storage of inventory and other materials in the warehouse environment. To control the flow of inventory into and out of the company's distribution centers, many companies have adopted warehouse management solutions. In the past few years, warehouse management solutions have evolved from complex systems that require special skills to operations and maintenance systems to automation systems that do not require extensive training. Today's warehouse management system is much cheaper than the previous system, more convenient to use, and more beneficial to the company. The warehouse management system is now associated with other systems used by the organization to speed up response and delivery times and improve visibility. Today's systems can also automate warehouse processes and increase productivity, so companies can focus on other places. With the continuous development of technology and the continuous expansion of the market, warehouse management will continue to become better. Stay tuned to our blog for more information on warehouse management development and how technology change shapes the way warehouses are managed.

### 2. SMART WAREHOUSES

The warehouse used to be nothing more than a large building with a row of shelves inside. The most complicated equipment in most warehouses is the forklift, and workers do not need to know a lot of technology to control the warehouse work.

The Smart Warehouse enables a variety of automation and interconnects technologies. These technologies work together to increase the productivity and efficiency of the warehouse, minimizing the number of labor and increasing errors.

Although the smart warehouse is still in the development and development stage, it is believed that the smart warehouse will allow the company to automatically receive orders, confirm that the items in these orders are in stock, and then use the robots that can be taken care of to fulfill the order [1]. The entire process will be monitored by a sensor network. Moving objects smoothly will allow human workers to focus on making the process as efficient as possible.

### **3. THE IMPACT OF TECHNOLOGY ON WAREHOUSE MANAGEMENT**

#### **3.1 Overall reduction in operating costs**

Well-designed smart warehouses reduce operating costs in a variety of ways. This type of system determines the most efficient use of labour and space, thereby reducing waste. Automated systems can help you determine where to keep certain materials, products and equipment to optimize warehouse traffic. Some advanced systems have warehouse simulators that allow users to create potential floor plans within the system. These simulators let you place pallets, shelves and other equipment you need to hold in the warehouse.

#### **3.2 Efficient labour management**

Automated warehouses gives you the freedom to decide which picking, packaging and storage methods are most effective for your business. In addition to helping to optimize inventory placement and route creation, technological solutions can also determine the best employees. Taking into account factors such as skill level, proximity and other tasks, Warehouse automation can help users assign work to each team member and lead to efficiency.

#### **3.3 Tracking of inventory clearly**

Inventory visibility is one of the most important components of a warehouse management system. WMS software provides real-time inventory data through barcodes, serial numbers and RFID tags. All of these methods enable the user to record all items as they enter the warehouse, all items on the floor of the warehouse, and the transportation process from one location to the next [2]. This visibility is necessary to create demand forecasts and provides insight into which products are most popular with customers.

#### **3.4 Facilitation of inbound and outbound logistics**

Just as users can optimize the location of inventory and equipment, they can also optimize how they move around the warehouse [3]. Once you plan to receive inventory, the benefits of the warehouse management systems provide inbound planning tools such as planning and shelf management. These tools allow you and your supplier to determine the best date and time to receive the shipment based on available labour and equipment.

#### **3.5 Transactional efficiency and improved customer relationship**

This feature allows you to use activity-based billing, which tracks all activities within a warehouse associated with a particular vendor and generates the appropriate fees. One of the most obvious benefits for suppliers is the reduction in waiting for terminals and loading areas. Customers enjoy overall improved order fulfilment, reduced lead times and reduced order inaccuracies. Under such a system, your company's reputation among customers and suppliers will improve.

#### **3.6 Warehouse technologies**

- Drones
- RFID
- On-Demand Warehousing
- Warehouse robotics
- Voice tasking technology
- Labour management systems
- Automated picking tools
- Automatic guided vehicles
- Collaborative robots [4]

### **4. THE FUTURE OF SMART WAREHOUSES**

#### **4.1 Complete automation**

Smart warehouses mainly consist of self-maintained machinery, as machines and devices become more connected to warehouse management systems, real-time functional metrics can be easily tracked and notification systems built to alert you when problems occur regarding the machine. This provides warehouse users with a completely transparent maintenance system because they can acquire real-time data [5]. Drones and collaborative bots are also being developed to cater to various warehouse requirements such as tracking physical inventory, tracking orders dispatched and transportation of the goods in house. Collaborative robots would interact with humans and enhance security within an automated environment.

#### **4.2 Predictive maintenance**

Information and data flow is enhanced and monitored, there is a clear way of doing things and preparing for any bottlenecks in the warehouse management process. Various companies around the world to achieve an advantage would create customized strategies and solutions to maintain and develop their smart warehouses.

#### **4.3 Eco friendly smart warehouses**

Automating your warehouse functions would reduce the pollution that is generated by various warehouses across the globe [6]. Smart warehouses would reduce the carbon and environmental footprint of any warehouse and it would substantially reduce the energy Bill's creating a sustainable environment.

#### **4.4 Linked supply chain and improved connectivity:**

Companies would be able to maintain connections with their vendors and carriers, they would be able to track the location of orders and estimated time of delivery if goods. Smart warehouses enable companies to track procurement of raw materials and

establish strong connections with trusted vendors. Smart automation hence would connect the supply chain and reduce overall costs leading to an efficient warehouse system.

## **5. SUGGESTIONS**

The automation of warehouses has led to some of the human resources becoming obsolete, there is scarce or no requirement of human interaction in smart warehouses. Instead there should be a considerate involvement of humans to increase supervision and maintenance within warehouses. Machines have a tendency of errors and hence there should be a process implemented where humans can rectify or ensure that the automated systems are working as per requirements. Another suggestion could include enhancing security of these automated systems as information is always easily accessible to hackers and companies may be prone to cyber-attacks putting all their information and data at risk. Companies usually implement technologies in their warehouses hastily, without analysing their resources, capabilities and requirements. Smart warehouses may not cater to their requirements as it is a very technical and complex process of shifting from a manual warehouse to a smart warehouse. Hence companies should carefully analyse their requirements and based on that they must implement the various warehouse technologies available to them.

## **6. CONCLUSION**

Warehouses have posed multiple problems for organizations when it comes to managing inventory, labour efficiency and visibility of stocks. Now there is no need for numerous warehouse managers and supervisors continuously marching around a warehouse to ensure efficient warehouse management, smart warehouses now make it easier to enter and track data and reduce unnecessary paperwork and task management. Picking efficiency is mobilized and the goods are transported efficiently across the warehouse ensuring sustainable inventory management. With numerous technologies available as mentioned in the article companies should be able to identify their requirements and resources and based on that implement various systems in their warehouses. It is clear that many or all companies in the near future will automate all their warehouses to reduce costs and increase productivity along with optimising stock levels. The companies adopting smart warehouses would hence gain a competitive advantage as they would have an automated supply chain and would be able to focus on their core competencies such as customer satisfaction and product quality. These smart warehouses would also help small companies grow and develop, providing various growth opportunities in countries across the world.

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