EXPLORING DIGITALIZATION IN WAREHOUSE MANAGEMENT IN BUSINESS LOGISTICS IN INDIA

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Abstract

Digitalisation has been an important topic to look at in warehouse management and logistics. In India, the use of traditional warehouses has shown limitations such as manual processes, low levels of accuracy, and inefficiency compared to modern warehouse management systems (WMS). There are several digital tools, including barcode scanners, RFID tags, IoT (Internet of Things) devices, and automation, that can improve warehouse performance. This study used secondary data to understand challenges within the Indian warehouse industry and then proposed solutions to overcome these challenges by implementing the identified technologies, providing worker training and integrating systems into the warehouse environment. One of the main findings of the research was that in order to enhance the efficiency and decrease overall operational costs created by current warehouse operations, companies need to embrace digital transformation in an effort to meet the growing demands within the supply chain.

Keywords: digitalization, warehouse management system, traditional warehousing, business logistics

Introduction

The rapid growth of trade and commerce globally as well as the continued complexity of supply chains has created a huge emphasis on the need for successfully managing logistics (Richey et al., 2022). Specifically, warehouse management within logistics is a key function to allow for the proper storage, movement and distribution of goods (Richards and Grinsted, 2024). Historically, warehouses relied heavily on using manual methods for performing such functions as inventory tracking, order fulfillment, and stock control. Unfortunately, these traditional methods of operation often resulted in various operation issues, such as inaccurate inventory records, slower order fulfillment, and increased operational costs (Zhang et al., 2023). As customers have become increasingly more demanding regarding the speed and reliability of shipping, warehouse operations have begun to implement various forms of digital technology to make improvements to warehouse operation efficiencies (Richey et al., 2022). Albeit, many companies, especially budding logistics companies in India are still unaware of the possibilities of warehouse management systems. Consequently, the paper discusses digitalization in warehouse management in business logistics in India.

Research aim: to suggest efficient digitalization tools to enhance warehouse management in Indian business logistics and to provide solutions to enhance the use of digitalization tools within the warehouses of Indian logistics companies.

The following **objectives** have been set to achieve the aim:

1. To explore the difference between traditional warehouse management and warehouse management systems.
2. To identify the digital tools that will address the operational challenges of warehouse management systems.
3. To find out the operational challenges of traditional warehouse management systems in India.
4. To propose solutions to improve the use of digitalization tools in warehouse management systems in India.

Research object and methods

Research object: digitalization in warehouse management in Indian logistics.

The paper implemented secondary research method to achieve the research objectives and to contribute more information on the research object. Secondary research method is conducted using existing literature based on digitalization in warehouse management in business logistics, by focusing Indian Logistics. Peer-reviewed journal articles, e-books, and research papers are used to analyze the object. These data are collected from Google Scholar, Google and Google Books. Keyword searching is used to collect the appropriate literature based on research aim and objectives. Literature published in English and published after 2022 is selected for the data analysis. While data collection, proper including and excluding criteria is followed.

Research results and discussion

Difference between traditional warehouse management and warehouse management system

The evolution of digital technologies and advanced logistic techniques which has changed warehouse management radically. The differences between traditional warehouse management and warehouse management systems can mainly be attributed to the way warehousing methods are organised, controlled and optimised. The methods of traditional warehousing tend to rely primarily on manual processes, requiring staff to directly supervise and manage the flow of

physical products in a warehouse (Abdunabiev, 2024). With traditional warehousing operations, documentation has typically been paper-based, whereas WMSs provide automated, real-time visibility over all aspects of warehouse operations using Barcode Scanning systems, along with a New Data Integration Capability. The method used to track inventory is one of the major differences between the two systems (Mohamud et al., 2023). With a traditional warehouse, stock records are typically kept manually on your computer or through a physical register. This makes it necessary for employees to conduct manual counts of the stock and update the inventory at various intervals which increases the chances of human error, inaccurate data and delays in the updating of information (Abdunabiev, 2024). These limitations may also result in problems such as stockouts, overstocking or items that are misplaced or not found. On the other hand, a Warehouse Management System will utilize automatic inventory management using technologies such as barcode scanning, RFID tagging, and digital databases. These technologies provide real-time tracking of the stock level and, therefore, give the Warehouse Manager immediate access to accurate information to make better decisions regarding operational improvements.

Table 1. Difference between traditional warehouse management and warehouse management system

Traditional warehouse management	Warehouse management system
Manual records and physical counting	Real-time tracking using barcode
Higher chances of human error	High accuracy with automated updates
Manual searching and picking	System guided picking and routing
Periodic updates	Real time monitoring and reporting
No integration with any system	Integrated with ERP or other systems

Order fulfilment and operational efficiency are also major areas where customers can differentiate between different types of warehouses. In a standard warehouse, a lot of work is done manually. For example, when an employee finds a product, picks the item, or prepares a package for shipment, it can take much longer than if the warehouse had a good storage system or some type of automated assistance (Hamdy et al., 2022). The lack of an effective method of locating products will result in employees spending even more time looking for the items they need, and will have a direct impact on the efficiency of processing orders and the number of picking errors made. In a WMS-enabled warehouse, operational efficiency will be greatly improved through the ability to provide workers with optimized routes for picking, automatically assigned tasks, and digital instructions (Abdunabiev, 2024). With the WMS, a warehouse owner can design the layout of their facility, identify the best locations to store inventory, and ensure that all items are picked and packed accurately; ultimately reducing the time it takes to process an order and improving the accuracy of an order's content. The next major difference between the two systems is the degree of visibility into warehouse operations and decision-making (Tubis and Rohman, 2023). Warehouse managers traditionally rely primarily on periodic reports, as well as on-site inspections, to evaluate warehouse performance. Therefore, they do not have real-time visibility into daily events occurring in the warehouse and are unable to respond rapidly to operational issues (Edirisinghe, 2023). Conversely, a Warehouse Management System provides real-time analytical capabilities and digital dashboards and the ability to produce detailed performance reports, which allow warehouse managers to make better decisions in a more timely manner based on a comprehensive view of the flow of inventory, employee productivity, and the status of orders.

The ability for growth and the ability to easily integrate with other business systems is another difference between the two systems (Khan et al., 2022). As business growth occurs, traditional warehousing operations typically do not provide the flexibility to easily expand due to extensive manual processes and the need for additional employees. A Warehouse Management System is designed to be capable of easily integrating with other core business systems to facilitate seamless data transfer and support the management of increased levels of order volume throughout the entire supply chain. Traditional warehousing is heavily reliant on manual processes which restricts the availability of real-time information (Mashayekhy et al., 2022). A Warehouse Management System or WMS brings forth automation to the process of warehousing and allows for a better management of inventory through all aspects from inventory control through customer delivery (Tubis and Rohman, 2023). As Supply Chains evolve to meet more demanding Customer needs, many companies are utilising advanced WMS technology to provide greater productivity, accuracy and overall logistics performance.

Digital tools which will address the operational challenges of warehouse management system

The use of digital technologies is becoming ever more integral to warehouse management in helping alleviate the operational issues faced by warehouses. The complexity of warehouse operations has increased with the rapid expansion of global trade, e-commerce, and customer expectations; therefore, traditional manual systems no longer provide sufficient means for maintaining operational efficiency and accuracy (Mohamud et al., 2023). Digital technologies enable businesses to automate repetitive tasks, better monitor their warehouse performance through operational data, and make better decisions in warehouse operations (Richards, 2025). By integrating modern software with advanced technology, many of the negatives associated with traditional warehouse methods have been addressed, leading to improved warehouse productivity, increased operational control, and higher levels of operational accuracy. Warehouse Management System is a common digital tool for managing warehouse activities. Warehouse Management Systems are computer programs that help plan, control and track many warehouse activities, including receiving items, storing them, picking them and shipping them (Mohamud et al., 2023). WMS operates in real time, therefore allows managers timely access to current amounts of stock and their location in the warehouse. Having access to real-time information about available stock and inventory in the warehouse allows warehouse managers to have better oversight of stock availability

and to track products without difficulty. The ability to have an objective snapshot of stock levels at any moment, will reduce the number of inaccuracies in stock records, reduce the chances of stockouts or excess stock, and increase overall accuracy of order fulfilment (Kembro and Norrman, 2022). Furthermore, many newer WMS could help warehouse workers to store and buy items faster and reduce unnecessary travel within the warehouse due to better optimised inventory placements and locations. Improved operational efficiencies will also lead to reduced amounts of time to fulfil orders (Richards, 2025).

Warehouse management also utilizes scan-based technology such as barcodes and RFID systems to improve operational efficiency. The use of barcodes provides a means for warehouse personnel to automatically identify and track the location of products as they transition through various processes in the warehouse by scanning product labels. By scanning product labels, warehouse personnel can assure that the data they enter into the inventory system is accurate and therefore reduces their dependence on manual data entry processes and minimizes the potential for human error when entering inventory data (Kembro and Norrman, 2022). RFID systems provide an even more advanced method of tracking and identifying products in bulk by allowing for the simultaneous identification and tracking of multiple items without requiring a direct line of sight between the RFID tag and the scanner, unlike barcodes, which require a direct line of sight. RFID tags can automatically transmit product data to the warehouse's inventory management system, allowing warehouse managers to receive product updates faster than with barcodes and provide for more accurate inventory tracking (Abdunabiev, 2024). By fully implementing both barcode and RFID systems in their warehouse operations, organizations can improve their accuracy of inventory data, shorten the time it takes to process data, and better control the flow of inventory through the warehouse. Warehouse efficiency is enhanced through the application of automation technologies, which address many of the operational challenges associated with warehousing (Richards, 2025). Examples of automation technologies include automated storage and retrieval systems, conveyor systems, and robot picking tools that improve the transportation and handling of materials throughout the entire warehouse. Through these automation technologies, the need for manual labour and thus the speed and reliability of warehouse operations are increased (Mashayekhy et al., 2022). The use of robotic pick solutions will assist the workforce in quickly and accurately selecting products to fulfil orders. As a result, through the reduction of manual handling, the use of automation technologies improves productivity, reduces operational costs and reduces the potential risk of injury within the workplace.

Warehouse operations can benefit tremendously from another digital innovation, namely the Internet of Things. With the use of IoT technology, organizations can use connected devices to obtain real-time information about their warehouses and monitor environmental conditions. For instance, a warehouse that holds sensitive items can use sensors to monitor temperature, humidity and illumination in their store (Mohamud et al., 2023). If any of these environmental conditions exceed acceptable limits, automated alerts will send notifications to warehouse managers so they can take immediate action to mitigate potential product loss due to spoilage or damage. IoT technology allows organizations to track how much equipment move throughout the warehouse as well. The data generated from IoT devices can also help warehouse management analyze operational performance by identifying inefficiencies, delays or bottlenecks in the warehouse process (Rajakrishnan, 2023). The introduction of cloud-based warehouse management systems has aided in making key advances in digital technologies for warehouses. This type of technology allows warehouse management system data to be stored remotely on web-based platforms instead of on a local computer server. By doing this, all supply chain members and warehouse managers can obtain their respective WMS data remotely and obtain real-time updates from any place and at any time. Cloud-based warehouse management systems are also designed to easily integrate with other business technologies such as ERP and TMS systems (Rajakrishnan, 2023). Additionally, cloud-based warehouse management systems can be easily modified to meet the changing needs of any business. As such, they provide businesses with the ability to expand their warehouse operations with little or no impact to their current IT architecture. Today, advanced data analytics and artificial intelligence are increasingly being used as digital tools for managing warehouses. These technologies allow businesses to analyze their operational data, identify trends within that data, forecast customer demand, and streamline inventory management processes. For instance, predictive analytics can assist warehouse management teams in forecasting customer demand and adjusting inventory levels in response (Mohamud et al., 2023). AI-based systems can also analyze and assess warehouse layouts and make recommendations on more efficient storage configurations or picking routes. By providing data-driven insights, these technologies help to reduce operational delays, make better use of resources, and improve the overall performance of warehouse operations.

Operational challenges of traditional warehouse management systems in India

Many researchers point out that the warehouse management practices in the Indian logistics sector are largely reliant upon manual processes and typically offer only limited use of modern technology, which creates a number of issues that hamper the ability of businesses to operate effectively and efficiently (Kumar et al., 2022). One major issue concerning Indian warehouse operations is the lack of real-time visibility to inventory (Rathee and Rani, 2025). Most traditional warehousing operations in India still use paper-based methods or basic spreadsheets for tracking the quantity and location of inventory data (Rathee and Rani, 2025). This has created a situation where businesses are unable to accurately track their inventories and ultimately creates problems such as stock shortages, overstock situations, and items becoming lost and out of stock. This kind of inaccurate inventory information frequently leads to serious problems during order fulfillment and ultimately reduces the satisfaction levels of customers (Mulla, 2022). In addition, manually entering inventory data takes a lot of time and also greatly increases the likelihood of mistakes being made due to human error (Mohamud et al., 2023). Another area where operational inefficiencies exist within warehousing operations in India is the order picking and material handling process (Kumar and Sudarvel, 2025). When employees are required to pick orders, they typically follow a printed list and have to walk through the warehouse to find the product that they are trying to pick.

In the absence of automated picking systems, such as automated picking equipment or route optimization software, employees waste a tremendous amount of time searching for the items that they need to pick because they do not have all of the tools necessary to perform their jobs quickly and effectively (Al Bashar, 2024). The absence of bar code scanning technology in most of the Indian logistics companies also increases the risk of employees picking the wrong items, which can lead to returns, additional transportation charges, and extended delivery times (Nataraj, Taylor and Briken, 2025). A key challenge is that of expedient information flow and data accuracy. Recordings via manual data entry and paper storage systems have an increased chance of errors occurring when data is recorded or updated regarding inventory transactions, such as receiving, storing and shipping products (Nataraj, Taylor and Briken, 2025). Therefore, when managers require accurate inventory information for planning purposes or managing stock levels, they will often be left with unreliable data on which to base their decision processes and optimize the store.

Many of the older, more traditional systems in Indian logistics, that warehouses do not provide a high degree of integration with the rest of the supply chain, such as the transportation management and enterprise project management systems (Sarkar, Shankar, and Kar, 2023). The poor connectivity between these different processes results in inefficient data sharing or coordination between departments, which ultimately contributes to a general level of inefficiency within the supply chain process. The poor usage of the space in the warehouse is yet another problem in the Indian logistics system. Warehouses typically use an experienced-based or non-analytical approach to designing the layout, with no advanced analytical tools or automated storage planning tools being available (Rana, 2023). This can cause blockages of aisles and workspaces, as well as longer distances to travel while picking and refilling items, resulting in poor levels of space usage and reduced productivity. Labor concerns pose another threat to warehouse operations. Warehouse processes rely heavily on manual labor in India (Nataraj et al., 2025). Therefore, their success will depend greatly on workforce availability and skill level. Managing large numbers of warehouse employees becomes challenging during high-demand months. Additionally, time and resources are needed to train new individuals, while inexperienced workers are often prone to making mistakes. The labor shortage, along with frequent changes in employees, may disrupt warehouse operations and slow down the fulfillment process in India (Nataraj et al., 2025). Warehouse dynamics have changed dramatically due to rapid e-commerce growth, more extensive product assortments, and growing consumer demands in India. As a result, many traditional warehouse systems struggle to keep up with current demand. These difficulties are responsible for slower speeds in processing, higher costs to operate, and lower service levels. Consequently, many companies are investing in new digital or automated warehouse management systems as solutions to the problems associated with these changes, as well as to improve overall logistics performance.

Solutions to improve the use of digitalization tools in warehouse management systems in India

In order to enhance the use of digital warehouse management systems (WMS) in India, an overall strategy needs to be developed to overcome the technology, organisation and human resources challenges that affect the use of Digital WMS. One of the most effective solutions identified was to deploy Advanced Digital WMS (real-time inventory management) via Barcode Scanners, RFID, and Cloud Technology (Rathee and Rani, 2025). These WMS provide increased visibility into stock levels while reducing manual errors and streamlining core functions (receiving, picking, packing and shipping) in the warehouse. Integrating WMS with ERP and TMS in Indian logistics, enhances data sharing and improves the effectiveness of the entire Supply Chain and enables faster and more informed decision-making (Shahla and Zeyu, 2025). Automating functions in Indian warehouse with Automated Storage and Retrieval Systems (ASRS), conveyor belts, and robotic picking solutions provides improved efficiency and accuracy while reducing reliance on manual labour, therefore, these improvements have made it easier to respond to the challenges presented by labour shortages and high employee turnover in the organisations in India (Nataraj et al., 2025). Furthermore, with the use of data analytics and AI in the warehouse, warehouse managers can improve the placement of their inventory, better predict demand for their inventory, and therefore improve the use of space in the warehouse which ultimately leads to lower operating expenses and better layout efficiency within Indian warehouse (Nataraj et al., 2025).

At the same time, investing in training employees and managing change positively through a variety of methods are important parts of adapting to the new requirements of modern businesses in India (Gupta et al., 2022). Businesses that invest in training employees to use new technology will see higher rates of successful implementation, thus leading to better performance for all parties involved. By promoting a culture of innovation within the organization, as well as by using tools and practices to reduce the fear associated with new systems and processes, organizations will be able to successfully eliminate the most common form of opposition, which is the fear of the unknown in traditional warehouses within India (Kumar et al., 2022). In addition, government programs and policies can help to facilitate and speed up the process of digital transformation within India's warehousing industry by providing financial rewards for businesses that embrace and implement new technologies, improve the quality of digital infrastructure, and foster and promote standardization of business processes across industries (Goswami and Daultani, 2022). Specifically, increasing access to the Internet and providing affordable technological options in semi-urban and rural areas are two important strategies that will help provide greater opportunities for greater participation by small and medium-sized enterprises (SMEs) in India and, in turn, strengthen the digital economy of those regions (Goswami and Daultani, 2022).

Partnering with third-party technology providers and logistics companies provides another option for organizations in India wanting to advance their digital journey (Choudhury et al., 2023). Utilizing third-party expertise and scalable solutions reduces the cost of implementation and accelerates the transition to digital technologies. The use of cloud-based technologies has provided organizations of all sizes with the ability and capacity to implement new technology with a low initial capital investment (Choudhury et al., 2023). In addition to utilizing cloud-based technologies, increasing the strength of cybersecurity measures is equally important to protect sensitive data and increase user confidence by providing

reliable systems. Thirdly, the use of IoT devices allows organizations to monitor their warehouse environments, such as temperature and humidity, in real-time; this is a key factor in food storage and the pharmaceutical industry (Kumar et al., 2023). Ultimately, ongoing performance monitoring and incremental improvements are essential for organizations to realize all the benefits that digitalization has to offer. Indian businesses should identify key performance metrics that will enable them to measure their productivity, accuracy, and efficiency of operations (Gadekar et al., 2022). They must also use data-driven insights to improve their process flows. With a combination of advanced technology, field-qualified human resources, favorable government assistance, and collective partnerships, warehouses in India can improve their operational efficiency significantly. Ultimately, making this transition will lead to greater efficiency and lower costs, give businesses the tools they need to meet the growing requirements for e-commerce and international trade, and create a foundation for sustainable business growth and competitiveness in the logistics sector.

Conclusions

1. Comparing warehouse management systems (WMS) to traditional warehouse management is a study in contrasts. Where traditional warehouse management relies upon manual processes, has limited visibility into operations and minimum system integration, WMS utilizes advanced technology such as automation, real-time data tracking, and other current tools to improve operational efficiency, increase accuracy, and enhance the ability to make informed decisions.
2. With the use of digital tools like WMS, barcode scanners, RFID technology, automation systems, the Internet of Things (IoT), cloud computing platforms, and artificial intelligence (AI), warehouses can overcome operational issues by increasing the level of accuracy of inventory records, increasing productivity, providing real-time information about inventory levels and facilitating the use of data-driven decision making.
3. In India, traditional warehouse management systems face multiple challenges that hinder the ability to effectively manage logistics operations. Some of these challenges include a lack of real-time visibility of inventory, inefficient operating processes, poor data accuracy, poor levels of system integration, and excessive dependence on manual labour, all of which affect the performance of logistics operations.
4. To support the growth and advancement of warehouse management through digitalization in India, organisations must invest in the implementation of new and emerging technologies; provide adequate training for their employees; implement government support initiatives; develop strategic partnerships; and continue to monitor and evaluate their performance in order to reduce costs, increase efficiency and respond to growing customer demand.

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