THESIS

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Supply Chain Management MSc

The effect of warehouse management in warehouse performance

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1. Introduction

In today's supply chains and logistics, warehousing is essential for ensuring goods move efficiently from manufacturers to consumers. As businesses work to meet growing customer demands, the complexity and importance of warehousing operations have increased significantly. Currently, warehouses do more than just provide storage, transport, and packing. Warehouses are essential to future-oriented planning, order fulfillment, product distribution, and strategic decision-making. Efficient warehouse operations are fundamental to enhancing supply chain productivity and meeting customer expectations in a highly competitive landscape. Serving as vital junctions, warehouses facilitate the storage, coordination, and distribution of raw materials, partially completed items, and finished products. The effectiveness of these functions directly affects a company's capacity to satisfy market demands, control operational costs, and maintain service quality. Consequently, optimizing warehouse management has become a strategic imperative for organizations aiming to improve overall performance.

Warehouse management covers a diverse array of responsibilities, including inventory oversight, order processing, space utilization, and logistics management. Ensuring the smooth transit of goods within and beyond the warehouse requires meticulous coordination of these activities. The introduction of advanced warehouse management systems (WMS) has significantly enhanced these operations by delivering real-time information, enabling automation, and providing data analytics to support better decision-making and operational refinement. The use of technologies such as barcode readers and robotics further boosts speed and accuracy, reduces the likelihood of errors, and enhances overall productivity.

Effective warehouse management has a multifaceted impact on operational performance, leading to more accurate inventory tracking, reduced operating expenses, quicker order fulfillment, and improved labor efficiency. Additionally, efficient warehouse management enhances customer satisfaction by ensuring timely and accurate deliveries. Conversely, poor warehouse management can cause inventory discrepancies, delays, higher costs, and a loss of competitive edge.

This research delves into the intricate dynamics of warehouse management and examines its direct influence on operational performance within warehouse settings. By reviewing existing literature and analyzing survey data, the study seeks to identify best practices and innovative strategies that promote operational excellence. Understanding the key elements that influence warehouse management helps organizations develop systems that not only improve efficiency but also align with broader strategic goals.

An efficiently structured warehouse management system (WMS) is essential for sustaining ideal inventory levels and facilitating seamless operational flow.. These systems enable precise tracking of just-in-time inventory, improve data accuracy, and support reliable demand forecasting. This allows warehouses to better organize goods, store items under suitable conditions, and reduce risks related to excess inventory, spoilage, and obsolescence. As a result, businesses can lower safety stock levels and minimize waste, creating leaner, more sustainable operations.

Central to modern warehouse management is the integration of automation technologies. Automation replaces repetitive, labor-intensive tasks with streamlined processes that boost speed, accuracy, and consistency. It also improves cross-departmental coordination by linking warehouse activities with procurement, production, and distribution. This interconnected approach increases transparency and responsiveness across the supply chain.

Adopting robust warehouse management practices yields numerous advantages, such as enhanced order precision, faster delivery times, and more effective utilization of resources. These gains are particularly crucial in today's globalized economy, where manufacturers navigate intricate logistics systems. Warehousing has evolved into a strategic operation that underpins the smooth intake, storage, and movement of goods and materials. Its performance plays a key role in enabling companies to satisfy global demand and meet their export obligations.

In today's competitive and fast-paced market, warehousing extends beyond simple storage; it is a cornerstone of logistics support and supply chain agility. By exploring warehouse management's dimensions and assessing their impact on performance, this thesis aims to

provide practical insights to help organizations optimize operations and stay competitive globally.

Efficient warehouse management also supports inventory optimization. By implementing techniques like ABC classification, just-in-time (JIT) inventory systems, and precise demand forecasting, warehouses can minimize stock shortages, lower storage expenses, and avoid surplus inventory. These practices lead to better inventory turnover and enhanced cash flow.

Effective warehouse management also promotes inventory optimization. By adopting strategies such as ABC analysis, just-in-time (JIT) inventory, and accurate demand forecasting, warehouses can reduce stockouts, cut storage costs, and eliminate excess inventory. This improves inventory turnover and cash flow.

Furthermore, a well-managed warehouse increases labor productivity. Using systems like WMS, along with technology such as barcode scanning and automation, streamlines tasks, lessens manual errors, and enhances staff efficiency. This not only raises productivity but also lowers labor costs and boosts employee morale.

Optimized warehouse practices can also maximize space utilization. Implementing effective strategies like slot optimization and intelligent racking systems allows warehouses to maximize storage capacity, minimize wasted space, and improve overall layout. This leads to better inventory organization, quicker product retrieval, and greater operational flexibility. In summary, efficient warehouse management has a significant impact on overall performance, enabling better order accuracy, faster processing, optimized inventory, increased labor productivity, and improved space use. By adopting sound inventory control methods, companies can achieve operational excellence, reduce costs, and maintain a competitive position in today's dynamic business landscape.

1. Evaluate the impact of inventory management practices on key performance indicators (KPIs).

2. How do targeted warehouse management approaches—like inventory control, streamlined order handling, strategic layout design, and technological integration—affect key performance indicators such as accuracy of orders, processing speed, inventory turnover, workforce efficiency, and space utilization?3. Identify critical success factors for effective

warehouse management. Explore the key factors or variables that contribute significantly to improving bearing performance. This includes elements such as technology adoption, process optimization, training and skills development, effective communication and employee engagement.

4. Analyze the relationship between warehouse management and customer satisfaction. Explore how effective inventory management practices impact customer satisfaction. How accurate and timely order fulfillment, inventory availability, and order tracking affect customer perceptions of service quality and overall satisfaction.

5. Examine how technology contributes to warehouse management by assessing the application and influence of systems such as warehouse management systems (WMS), automation tools, barcode scanners, RFID, and other innovations. Analyze how these technologies enhance operational efficiency, minimize errors, and elevate overall warehouse performance.

6. Discover the challenges and obstacles to effective warehouse management.

Identify common challenges and barriers faced by organizations in implementing and maintaining effective inventory management practices. Understand the factors that impede performance improvement and explore possible solutions and strategies to address these challenges.

Warehouse management plays a pivotal role in the supply chain, influencing multiple aspects of operations with far-reaching effects. When managed effectively, it drives higher productivity, reduces expenses, and improves customer satisfaction. On the other hand, poor warehouse management can cause delivery delays, lost inventory, and dissatisfied clients.

Here are some of the key ways that warehouse management can impact the supply chain:

- Efficiency: A well-managed warehouse can help to improve efficiency by streamlining processes, reducing waste, and increasing productivity. This can result in reduced turnaround times, decreased operational expenses, and enhanced customer satisfaction.

- Costs: A well-organized warehouse plays a key role in cost reduction by fine-tuning inventory levels, minimizing handling expenses, and maximizing the use of available space. These efficiencies translate into substantial savings for companies, regardless of their size.
- Customer satisfaction: Streamlined warehouse operations play a crucial role in elevating customer satisfaction by enabling prompt and precise order fulfillment. When deliveries are consistently accurate and timely, customers are more likely to trust the brand, return for future purchases, and recommend the company to others. This operational reliability not only boosts customer loyalty but also reinforces the company's reputation in the marketplace, contributing to long-term business success.

In addition to these direct impacts, warehouse management can also have a positive impact on the supply chain by helping to improve visibility, reduce risk, and increase flexibility.

- Visibility: A well-managed warehouse can help to improve visibility of inventory levels and shipments. This can help businesses to make better decisions about production, planning, and transportation.
- **Risk Mitigation** Effective warehouse management minimizes the risk of product damage, theft, and loss. By safeguarding inventory and streamlining operations, businesses can avoid financial setbacks and ensure timely delivery to customers.
- **Operational Flexibility** A well-run warehouse enhances adaptability by enabling quick responses to shifts in demand. This agility helps companies handle sudden surges in orders and prevents stockouts, maintaining smooth service continuity.
- **Strategic Importance** As a foundational element of the supply chain, warehouse management exerts a broad and significant impact. By enhancing operational performance, reducing expenses, and improving customer satisfaction, it enables organizations to achieve their goals and foster long-term growth.

2. Literature review

2.1 Warehouse theory as central process of the supply chain:

Van den Berg (2012) characterizes warehouse management as a continuous endeavor to enhance the operations, organizational framework, and technological systems of distribution centers, while also fostering collaboration with supply chain stakeholders. He emphasizes a holistic strategy that explores various avenues for optimization within competitive warehouse environments. Regardless of its location in a company's logistics, if a facility is used for storage, picking, and shipping, it is referred to as a warehouse Rushton et al. (2000), there are several reasons for keeping stock and maintaining warehouses and distribution terminals in supply chains:

Warehouses play a critical role in managing both anticipated and unexpected disruptions in production. Their core resources—space, equipment, and personnel—must be effectively utilized to meet customer expectations. Clients primarily seek timely delivery of the correct products in good condition, which means items must be readily available and securely stored. When a warehouse fails to meet these criteria, it not only fails to add value but may actually diminish the product's worth. Therefore, the central aim of warehouse management systems is to optimize the use of space, tools, labor, accessibility, and security of goods and information, all aligned with resource evaluations and customer demands.

Jessop et al. (1986) describe a store as a provisional holding area for materials essential to operations, emphasizing that it should be organized to minimize the duration each item remains in stock while maintaining economic efficiency. Tompkins et al. (1998) expand on this by defining storage as the oversight of warehouses and stockyards, the operation of handling and storing equipment, and the safeguarding of inventory. They also outline storekeeping as the set of procedures for receiving, identifying, storing, issuing, tracking, and replenishing goods, all in line with service standards and health and safety regulations.

According to Tsige (2013), warehousing involves the large-scale, systematic storage of goods, ensuring they are accessible when needed. It adds time utility by bridging the gap between production and consumption. Hackman (2014) notes that reducing travel time

between supply points and demand centers can significantly boost efficiency. To achieve this, manufacturers must implement systems that consistently monitor picking routes and storage placements. Shah and Khanzode (2017) assert that the purpose of a warehouse is to meet customer needs through efficient resource use, ensuring the delivery of the right product, in the right condition, at the right place and time. Warehouses also serve multiple functions, including temporary storage, product protection, order fulfillment, packaging, post-sale services, repairs, testing, inspection, Just-in-Time (JIT) sequencing, and assembly.

2.2 Warehouse definition:

Warehouse operations typically fall into four main categories: receiving, picking, storing, and shipping. The storage function encompasses tasks such as assigning departments or zones, while picking involves activities like batching, routing, and sorting. According to Paul and Lestari (2015), warehousing refers to the management of goods housed within the facility. Despite the diversity of warehouse tasks, common operational patterns exist, including receiving, put-away, replenishment, internal picking, sorting, packing, cross-docking, and delivery.

Faber (2015) emphasizes that warehouse performance focuses on lowering costs, boosting productivity, and enhancing responsiveness to customer needs. Performance metrics help assess how well a warehouse meets expectations or compares to industry standards, offering insights into the effectiveness of its management systems.

People and Processes: Managers are responsible for ensuring that warehouse staff carry out procedures effectively. This includes training, motivating, and listening to employee feedback (Linde & Olhager, 2016). Stoltz et al. (2017) argue that without standardized procedures, each worker may perform tasks differently. By identifying and combining the best elements from individual approaches, managers can establish superior practices. Moreover, the absence of formal procedures makes it difficult to hold staff accountable.

Technology and Innovation: Modern tools and systems can greatly improve warehouse efficiency. Solutions like automated conveyors, robotic cranes, and warehouse management software streamline operations and enhance productivity. Van den Berg (2012) advocates for

adaptable and intelligent IT systems that support operational needs and can be easily updated to reflect evolving market demands.

Business Integration: Warehouses often function as service units within organizations, supporting departments like sales and purchasing. Yener and Yazgan (2019) suggest that aligning departmental goals with broader company objectives can lead to significant improvements in distribution center performance. Faber et al. (2013) describe warehouse management as the daily coordination and optimization of material flow and resource use to meet customer demands while minimizing waste.

Strategic Role in Supply Chains: Warehouses are central to sourcing, production, and distribution. They handle raw materials, semi-finished, and final goods, acting as dispatch centers for subsequent supply chain stages. Baker (2007) notes that market volatility, expanding product ranges, and shorter lead times have reshaped warehouse roles. Facilities must be designed to meet specific supply chain needs and operate cost-effectively, as they represent one of the most expensive components of logistics.

Hackman (2014) highlights the warehouse's role in repackaging goods—transforming bulk shipments into smaller units for customer delivery. For instance, items may arrive in pallets but be shipped as cases or individual units. More (2016) adds that globalization and emerging challenges like reverse logistics and sustainability are driving changes in warehouse responsibilities, making their performance critical to overall supply chain success.

Operational Breakdown: (2017) outlines key warehouse processes: receiving, put-away, replenishment, picking, sorting, packing, cross-docking, dispatch, and shipping. Inbound processes include receipt and storage, while outbound tasks involve distribution. Warehouses often repackage large-scale goods into smaller units, a labor-intensive process that directly affects picking time and accuracy.

Inventory Management: Effective inventory control is vital for business health. Excess stock ties up capital, while shortages risk lost sales. Magloff (2010) explains that barcode and UPC systems improve inventory tracking by labeling items with essential data, enabling real-time monitoring through scanning devices and software.

Small enterprises may use manual methods like stock books, which work for limited inventories but become inefficient as businesses grow. Digital systems offer scalable solutions. The Kanban method, derived from Japanese retail practices, uses visual cues to signal restocking needs. Though effective for stable demand, it may not suit complex inventory patterns (Magloff, 2010).

Performance Evaluation: Neely et al. (1995, as cited in Agami, Saleh, & Rasmy, 2012) define performance measurement as assessing how well actions meet objectives. Effectiveness relates to fulfilling customer needs, while efficiency concerns resource use. Akyuz and Erkan (2010) note the lack of consensus on performance definitions, though most scholars agree it includes both financial metrics (e.g., ROI, revenue) and operational indicators (e.g., inventory accuracy, cycle time) as outlined by Martin & Patterson (2009).

Table 1: Impact of Warehouse Management on Productivity

Metric	**Before WMS Implementation**	**After WMS Implementation**	**Improvement (%)**
Inventory Accuracy	85%	99.5%	+17%
Order Picking Accuracy	90%	98%	+8.9%
Labor Productivity	100 units/hour	130 units/hour	+30%
Order Cycle Time	48 hours	24 hours	-50%
Space Utilization	70%	85%	+21.4%
Stockout Frequency	**12/month**	**3/month**	**-75%**

Source: Company productivity metrics

This dual perspective highlights the importance of a balanced approach to performance assessment, combining quantitative financial outcomes with qualitative operational insights to gain a comprehensive understanding of organizational success.

2.3 Warehousing activities:

Table 2: Warehousing main activities

Activity	**Description**	**Tools/Systems Used**	**Impact on Productivity**
Receiving	Accepting goods from suppliers and verifying accuracy	Barcode scanners, WMS	Reduce errors and delays
Put-away	Moving items to storage locations	RFID, mobile terminals	Improves space utilization
Inventory Management	Tracking stock levels, locations, and conditions	WMS, ERP, cycle counting	Enhances inventory accuracy
Order Picking	Selecting items for customer orders	Pick-to-light, voice picking	Speeds up order fulfillment
Packing	Preparing items for shipment	Packing stations, automation	Reduce damage and errors
Shipping	Dispatching goods to customers	TMS, barcode scanners	Improves delivery speed

Source: Experience within warehouse operations

Receiving is the starting point of warehouse operations. While it may take less time than activities like picking, its significance is just as vital—particularly because mistakes during putaway can affect later stages. This process usually begins with prior notification of arriving goods, enabling the warehouse to organize and manage inbound logistics effectively.

Upon arrival, items are unloaded, documented, and staged for putaway. Scanning the products confirms their receipt, establishes ownership, triggers payment processes, and updates inventory availability for customer orders. A thorough inspection follows to identify any discrepancies, such as damage, incorrect quantities, or mismatched descriptions. Proper receiving sets the foundation for all downstream activities including storage, picking, and

shipping, making it essential for smooth warehouse operations (Habazin, 2017). Receiving typically accounts for approximately 10% of operational expenses in a standard distribution center (Bartholdi and Kackman, 2011). Prior to storing incoming goods, it's essential to identify suitable storage locations. This decision significantly influences the speed and cost of future retrievals for customer orders. Managing this aspect involves tracking a secondary inventory—not of products, but of storage spaces. Warehouse staff must continuously monitor available locations, considering factors like size and weight capacity. Once items are placed, scanning the designated area to record their position is vital for creating accurate pick lists that assist order pickers. The put-away process can be physically demanding, especially when items must be moved across large distances within the warehouse. It generally comprises about 15% of total warehouse activities (Bartholdi & Kackman, 2011).

Order Picking Order picking follows put-away and involves assigning customer orders to multiple pickers. To maintain control and efficiency, warehouses often divide the picking area into zones, each managed by different personnel under a zoning policy. Orders may be picked individually or in batches, following a set sequence.

Picking methods vary:

- **Manual Picking**: Workers collect items from storage and deliver them to a picking area.
- **Automated Picking**: Automated storage and retrieval systems (AS/RS) bring unit loads to a picking station, where pickers select the required items. Remaining goods are returned to storage.

Order picking is typically the most costly warehouse activity due to its high labor or capital demands. It involves retrieving specific SKUs in designated quantities, which may include:

- **Broken Case Picking**: Selecting fewer units than a full case.
- **Full Case Picking**: Picking quantities equal to or multiples of a full case.
- **Pallet/Bulk Picking**: Retrieving entire pallets for large orders.

Shipping typically involves handling larger units than picking, as packing consolidates items into fewer containers such as cases or pallets. This consolidation reduces the labor required during shipping. However, some walking may still be necessary, especially when products are staged before being loaded onto freight carriers. Staging is often needed for long-distance shipments or when items must be loaded in reverse delivery order, which can increase workload due to double-handling. Trailers are usually scanned at this point to confirm their departure from the warehouse (Bartholdi & Kackman, 2011). Shipping encompasses tasks that prepare goods for customer delivery and involves placing them onto transport vehicles. Like other warehouse functions, shipping requires a dispatch area for managing information and coordinating staff responsibilities such as verifying packing, labeling, and loading.

Frazelle (2002) emphasizes that warehousing plays a vital role in a company's competitive edge, influencing financial outcomes, productivity, quality, and cycle time. To ensure smooth operations, warehousing must be held accountable for these performance areas. He identifies four key performance indicators: two for inbound processes—put-away accuracy (percentage of correctly stored items) and inventory accuracy (percentage of locations without discrepancies)—and two for outbound processes—picking accuracy (error-free order lines) and shipping accuracy (correctly shipped order lines).

According to Chalotra's study (Venul, 2013), warehouse performance is influenced by factors such as extended lead times, inefficient layouts, inconsistent deliveries, and inaccurate demand forecasting. Yu and De Koster (2010) introduce the concept of dynamic storage, which enhances order throughput and reduces labor costs by minimizing travel distances during picking.

To evaluate and improve warehouse performance, process mapping is recommended as a method to visualize all operational activities. Warehouse functions—receiving, storing, picking, and shipping—impact corporate performance in terms of cost, quality, speed, and productivity. Each function carries its own cost implications and quality metrics, such as order accuracy and response time, which should be continuously monitored and refined.

Order processing:

Order Fulfillment Costs and Management The process of fulfilling customer orders encompasses a range of cost components, such as order processing, customer service support, inventory storage and upkeep, shipping logistics, and product tracking systems. Each of these elements contributes to the overall operational expenses associated with delivering goods to customers. Gaining a clear understanding of how these activities are managed enables business leaders to develop more accurate budgeting strategies, monitor employee performance effectively, and pinpoint opportunities for reducing costs and enhancing operational efficiency

Role of Customer Service Customer service representatives are essential in processing orders—whether placed by mail, phone, or online. They ensure order forms are complete with necessary details like customer information and product specifications. They also follow up to clarify missing data and respond to post-delivery inquiries.

Warehouse Operations and Staffing Once an order is received, the shipping team locates the item in inventory, typically stored in large warehouses. The cost of maintaining these facilities varies by size and location. Staffing needs depend on inventory volume and order activity, and may include pickers, packers, managers, quality control, maintenance, and janitorial personnel (Jones, 2012).

Shipping and Packaging Shipping involves verifying orders, securely packaging items, and transporting them via company vehicles or third-party services. Products are usually packed with foam inserts to prevent damage. Shipping costs are influenced by the product's weight.

Order Processing Systems Order processing is a central component of fulfillment. These systems have evolved with technology to offer robust tools for capturing, tracking, and shipping orders. Advanced platforms can manage international logistics, returns, and diverse product lines across global markets (Kagawa, 2008).

2.4 Warehouse management system (WMS):

In contemporary warehouse environments, the adoption of a Warehouse Management System (WMS) is crucial for enhancing efficiency in core functions like receiving, order picking, and shipping. WMS enhances these processes by reducing errors, accelerating workflows,

and improving inventory accuracy through technologies like RFID scanners, barcode readers, and mobile computing devices.

Performance in warehouse operations is typically measured using four categories: input, output, efficiency, and effectiveness. These metrics help quantify how well a warehouse delivers its services and manages its resources. Efficiency and effectiveness are the most commonly used indicators, reflecting how smoothly and accurately operations are executed (Kusrini et al., 2018).

A WMS functions as a database-driven application that manages inventory transactions and directs product movement within the facility. It determines optimal storage locations based on item characteristics and turnover rates, and supports advanced picking methods such as zone picking, wave picking, and pick-to-light systems. These features guide employees with real-time digital instructions, minimizing confusion and improving order accuracy.

Shipping operations also benefit from WMS automation, which handles label generation, carrier selection, and documentation. Integration with Transportation Management Systems (TMS) further streamlines outbound logistics, ensuring timely and precise deliveries.

Auto ID Data Capture (AIDC) technologies—such as barcode readers, wireless networks, and RFID—are used to track the movement of goods. The gathered data is either uploaded in batches or sent instantly to a centralized system, which then produces detailed inventory reports (Ramaa et al., 2012; Atieh et al., 2016).

WMS also supports advanced warehouse structuring through zones and bins, facilitating directed putaway and picking. Zones may include receiving or stocking areas, each containing multiple bins. Automating these processes reduces human error and enhances warehouse utilization.

Ultimately, the goal of a WMS is to provide a comprehensive set of digital procedures for managing stock receipt, returns, storage, and order fulfillment. Transitioning from manual inventory management to a computerized WMS significantly reduces errors and eliminates paperwork, making operations more reliable and efficient (Naseed & Husain, 2013).

2.5 Challenges for warehousing activities:

It worth to mention that, while doing all the activities physically and in a system, we will have some challenges as stated below:

Warehouse operations face a range of challenges that can significantly impact inventory accuracy and overall efficiency. At the receiving stage, common issues include miscounts due to human error, incorrect data entry, misread labels, and product mix-ups—often caused by the absence of clear placement regulations. These mistakes can confuse employees during documentation and result in inaccurate stock records. In the put-away phase, simply grouping similar products isn't enough. Products should be organized according to factors like how often they are ordered, with frequently requested items stored in easily reachable locations. This arrangement enables quicker access and improves visibility, helping warehouse staff promptly identify problems such as stock shortages or misplaced inventory.

Storage access presents another challenge. Without proper regulation, unauthorized personnel may enter storage areas, leading to discrepancies and potential losses. Ideally, only employees with supervisor-approved order bills should access inventory for picking. However, the lack of formal access controls allows unintended entry, and inadequate or poorly designed storage space further complicates inventory management. During order picking, inefficiencies arise from poor product placement and obstructed pathways. Employees may need to move other items to reach the required goods, increasing process time and disrupting workflow. These delays are often compounded by the physical layout of the warehouse, which can hinder smooth movement and access. (Andjelkovic, A. and Radosavljevic, M., 2018)

Shipping, while less directly affected, still suffers from delays caused by inefficiencies in earlier stages. Bottlenecks in receiving, put-away, or picking accumulate and ultimately impact shipment timelines. Although shipping itself may operate smoothly, it inherits the consequences of upstream disruptions, affecting the overall output and customer satisfaction.

Inventory accuracy challenge: Inventory inaccuracies represent a critical challenge in warehouse management, often resulting in lost revenue and operational inefficiencies. These discrepancies arise when stock records differ from the actual quantities on hand, causing

issues like excess inventory, shortages, and flawed order fulfillment. A major cause is human error—from mislabeling items and miscounts during stock intake to manual data entry mistakes. Additional factors include reliance on outdated inventory systems and the physical displacement of goods. Without precise real-time tracking, stock movements become difficult to manage, particularly in high-speed e-commerce settings. Losses through theft or damage further skew recorded figures. Ineffective interdepartmental communication exacerbates errors by triggering redundant orders or missed restocks. In turn, inaccurate data hampers demand forecasting and disrupts procurement strategies, tying up capital in unsold goods. Technologies such as RFID tagging, automated inventory counts, and barcode scanning provide more reliable data capture. Advanced warehouse management systems mitigate manual errors by consolidating and updating inventory data. Regular inventory audits and targeted employee training are critical for sustaining accuracy. Ultimately, maintaining trustworthy inventory figures is essential to ensuring operational fluidity and meeting customer expectations. (Karine Semonsi, Iuri Rafael Destro, April 2023)

Poor space utilization: Efficient use of space is essential in warehouse operations, as poor spatial planning can severely hinder workflow and productivity. When floor layouts are not optimized, they result in underutilized areas, longer travel routes for staff, and delays in picking and packing processes. Vertical storage potential is frequently overlooked, leaving valuable overhead areas unused. Improper aisle widths—either too narrow or unnecessarily wide—can interfere with movement and reduce overall storage efficiency. Overstocking during busy periods without flexible storage options creates clutter, while insufficient stock leads to empty shelves and wasted space. Without strategic slotting, high-demand items may be placed in inaccessible locations, slowing down retrieval times. Inconsistently arranged shelving and unclear labeling systems add to operational inefficiencies by making products harder to find. Warehouses lacking adaptable storage infrastructure often face difficulties adjusting to fluctuating inventory volumes. Unsafe stacking practices and poor planning can also increase the likelihood of workplace accidents. To counter these challenges, implementing modular shelving, mezzanines, and mobile units can dramatically expand storage capacity. Warehouse Management Systems (WMS) with live inventory updates empower smarter space assignment. Techniques like cross-docking and just-in-time stocking reduce the need for excess warehousing. Conducting regular reviews and using layout

simulation tools helps identify bottlenecks and make necessary adjustments. In the end, maximizing space utilization translates to higher throughput, lower operational costs, and greater flexibility. (Petropoulos, F. *et al.* (2025)

Labor shortages have become a persistent and pressing issue in the logistics industry, particularly as the surge in e-commerce and the demand for rapid delivery services continue to reshape consumer expectations. With customers increasingly prioritizing speed and precision, warehouses are under mounting pressure to maintain high levels of operational performance despite significant staffing challenges. The difficulty in attracting and retaining skilled workers stems from several factors, including the physically demanding nature of warehouse roles, relatively low wages, and limited prospects for career advancement.

Workforce limitations significantly affect the stability of warehouse operations. Frequent employee turnover disrupts workflow continuity, places additional strain on training efforts, and diminishes accumulated organizational expertise. When seasoned staff depart, operational efficiency and reliability decline, resulting in slower task execution and increased error rates. These issues become more pronounced during high-demand periods like holidays or promotional campaigns, when warehouses must depend on temporary workers. Although these employees help manage short-term surges, their limited training and unfamiliarity with warehouse procedures can lead to reduced accuracy and a drop in service standards (Amin, Sugianto, Firdaus, & Suhardi).

To effectively address labor shortages, logistics organizations must adopt a comprehensive strategy that goes beyond short-term fixes. Enhancing working conditions—such as improving ergonomics, offering flexible schedules, and ensuring a safe and supportive environment—can make warehouse roles more attractive. Competitive compensation packages and benefits are also essential to drawing and retaining talent in a competitive labor market. Furthermore, providing clear career pathways and opportunities for professional development can foster long-term commitment and motivation among employees.

Investing in employee engagement is equally critical. When workers feel valued, supported, and connected to the organization’s goals, they are more likely to contribute positively to performance and remain with the company. Programs focused on employee recognition, structured feedback, and collaborative team-building can significantly boost morale and

foster a more unified workforce. When warehouses emphasize staff retention and invest in employee development, they can minimize turnover, decrease the expenses associated with training, and improve overall operational efficiency.

Ultimately, overcoming labor shortages requires a shift in how logistics companies view and manage their human capital. A resilient, well-supported workforce is not only essential for meeting operational demands but also for sustaining long-term growth and competitiveness in an increasingly fast-paced and customer-driven market.

This challenge is further compounded by an aging workforce and declining interest among younger individuals in manual labor roles. Regional disparities in labor markets also contribute to the problem, with some areas facing intense competition for qualified workers—driving up labor costs and reducing availability. When staffing levels fall short, warehouses experience delays in shipments, increased overtime expenses, and a drop in customer satisfaction.

To address these issues, companies are increasingly adopting automation, artificial intelligence, and robotics to reduce dependence on manual labor. Workforce management tools that assist with scheduling and performance tracking help improve operational efficiency. Additionally, offering better employee benefits, flexible shifts, and career development programs can enhance retention. Partnering with trade schools and implementing referral programs are effective strategies for attracting new talent. Cross-training existing employees also boosts flexibility and helps maintain continuity during staffing gaps.

Seasonal Demand Fluctuations: Warehousing operations frequently encounter significant changes in demand during holidays, promotional events, and seasonal product launches. These sudden shifts can place immense pressure on facilities that lack flexible infrastructure. Excess inventory during peak periods creates overcrowding, while too little stock results in lost sales opportunities and disappointed customers. Demand spikes also raise workforce requirements, often prompting the use of temporary personnel who may not be sufficiently trained. When product volumes swell, spatial limitations become increasingly apparent. Ineffective facility layouts and poor planning only worsen the situation. In the absence of accurate forecasting tools, it's difficult for warehouses to predict customer behavior and

allocate labor and inventory appropriately. Consequently, receiving, picking, and shipping processes slow down, increasing the risk of delays. To tackle these challenges, many organizations rely on historical trends and forecasting software to plan ahead. Adaptive staffing strategies, including seasonal hires and employee cross-training, help meet short-term operational needs. Warehouse design solutions such as adjustable slotting and modular storage systems improve space efficiency. Fulfillment speed can be enhanced with technologies like automated conveyors and robotic pickers. Cloud-based warehouse management systems provide the agility needed for real-time adjustments and remote control. To reduce surplus inventory, certain facilities implement just-in-time (JIT) strategies. Successfully managing seasonal demand fluctuations calls for adaptable planning, agile systems, and well-coordinated resource allocation (Shanmugamani & Mohamad, 2023).

Integrating various technologies—such as Warehouse Management Systems (WMS), Enterprise Resource Planning (ERP), Transportation Management Systems (TMS), robotics, and IoT—can be a challenging endeavor for warehouse operations due to the complexity of aligning multiple systems. Many legacy platforms are not built to interact smoothly with newer technologies, which leads to isolated data streams and poor communication across tools. When information must be entered manually or comes in incompatible formats, mistakes and delays become unavoidable. Without synchronized systems, real-time monitoring and control suffer. While middleware can serve as a bridge between disconnected technologies, implementing it effectively takes time and expertise. Tailoring software to specific operational needs can further drive up costs and add layers of complexity. Resistance to adopting new tools—either from frontline workers or IT teams—can stall progress. Addressing these challenges requires comprehensive staff training to foster confidence and facilitate seamless operational changes. Effective automation also depends on proper integration, as equipment such as conveyors and robotic pickers must be synchronized with backend systems to operate efficiently (Rakhmasari, Dharmayanti, & Abdusyakur, 2025). When systems remain fragmented, it becomes difficult to efficiently manage inventory, staff schedules, and space allocation. The adoption of cloud-based platforms helps simplify maintenance and scaling. Leveraging APIs and modular system designs enhances compatibility and flexibility. Testing new systems through phased deployments minimizes

risk and disruption. Partnering with experts who specialize in system integration can streamline the process. Ultimately, a well-integrated tech ecosystem supports more efficient operations, fewer errors, and smarter strategic decisions.

Warehouse management has a profound impact on the efficiency, scalability, and adaptability of warehouse operations. It ensures inventory accuracy by reducing discrepancies with technologies like RFID and barcode scanning, boosting fulfillment speed and customer satisfaction. Smart space utilization—through dynamic shelving, vertical storage, and real-time tracking—prevents congestion and maximizes capacity.

Workforce challenges such as labor shortages and turnover are mitigated with automation, flexible staffing, and training, while predictive planning helps facilities manage seasonal demand spikes. Reverse logistics, often overlooked, becomes streamlined with dedicated returns zones and integrated tracking, improving sustainability and customer experience.

Technology integration is central to modern management, with cloud-based platforms and APIs enabling seamless coordination among systems like WMS, ERP, and robotics. Finally, sustainability is advanced through energy-efficient infrastructure, eco-friendly packaging, and real-time monitoring of environmental impact.

Altogether, effective warehouse management transforms operations into agile, accurate, and resilient systems that meet evolving demands and drive long-term success.

3. Company investigation

3.1 Company: Schneider Electric

Schneider Electric, a multinational corporation based in France, is recognized globally for its expertise in energy management and automation. The company offers an extensive range of products, software, and services designed to meet the needs of various industries, including energy and infrastructure, industrial operations, building control systems, and data center management. With a strong emphasis on digital transformation, energy efficiency, and innovation, Schneider Electric drives sustainable and intelligent operations across homes, buildings, infrastructure, and industries.

Employing approximately 135,000 people worldwide, the company's vast supply chain involves over 80,000 employees—underscoring the scale and complexity of its global logistics and operational network.

The company manages a vast network, handling 150,000 order lines daily and maintaining a catalog of nearly 200,000-300,000 items. These range from small products like plugs and sockets to room-sized circuit breakers. Schneider Electric operates 91 distribution centers and 183 factories worldwide, supported by over 14,000 suppliers.Schneider Electric, being a global company, has distribution centers strategically located around the world to efficiently manage the storage, handling, and distribution of its products. The exact locations and number of distribution centers may change over time due to the company's evolving logistics strategy.

Schneider Electric has several key goals for its supply chain:

- Sustainability: Prioritizing CO2 reduction and establishing a circular economy.
- Customer-Centric Delivery: Shifting from customized solutions to reliable service based on customer purchasing patterns.
- Business Model Readiness: Quickly adapting to market changes.
- Resilience: Maintaining strong cybersecurity and ensuring seamless customer experience during major events.

- Intelligence: Enhancing demand sensing, end-to-end orchestration, and achieving automation and autonomy.
- Speed and Efficiency: Leveraging regional setups for rapid response and developing critical relationships with suppliers and customers.

Company's key activities:

- Electrification: Delivering solutions for electrical distribution and automation.
- Automation: Supplying industrial control systems and building automation.
- Energy Management: Providing products and services for efficient energy use and sustainability.

Schneider Electric leverages its proprietary EcoStruxure platform to seamlessly connect warehouse automation and energy management systems across all levels of operation—from individual edge devices to enterprise-wide infrastructures. This integrated approach improves operational transparency, supports flexible and responsive workflows, and promotes more efficient use of resources, contributing to environmentally sustainable practices.

Schneider Electric has outlined bold sustainability objectives, targeting carbon neutrality in its internal operations by 2025 and across its entire value chain by 2040. A key driver of this initiative is EcoStruxure, which has already helped customers avoid over 120 million metric tons of CO_2 emissions. The company is progressing toward a cumulative emissions reduction goal of 800 million metric tons.

EcoStruxure provides a robust suite of tools designed to support sustainability efforts, including capabilities that can cut energy consumption by up to 50%, reduce carbon emissions by as much as 40%, and offer sophisticated tracking systems to monitor progress toward net-zero objectives.

A key example of Schneider Electric's logistics excellence is the Central Eastern Europe Logistics Center (CEELog) located in Szigetszentmiklós, Hungary. This smart distribution hub handles deliveries across more than 20 European countries, spanning from west to east and north to south. Recognized with a Smart Distribution Center award, the facility has

significantly improved efficiency and effectiveness through targeted enhancements. Over 200 employees manage both warehouse and production activities, with a daily delivery capacity of 17,000 units—equivalent to 130 tons of shipments. Two automated guided vehicles (AGVs) operate continuously to boost productivity. Globally, Schneider Electric operates more than 300 smart centers, reflecting the scale and sophistication of its supply chain infrastructure.

The integration of robotics and artificial intelligence into warehouse operations significantly enhances accuracy, speed, and overall productivity. Automated systems are highly effective at performing repetitive tasks with reliable precision, minimizing human error and improving order fulfillment efficiency. These innovations are essential for meeting growing customer demands and staying competitive in the market. Additionally, AI contributes by analyzing vast amounts of data to refine processes such as routing, picking, and packing.

Equally important is strategic space management, which ensures optimal use of warehouse capacity and streamlines workflow. By carefully planning shelving and storage layouts, businesses can maximize every square foot of space. Techniques such as vertical storage, dynamic slotting, and cross-docking help reduce congestion, shorten travel paths, and boost productivity. These improvements not only enhance operational flow but also generate cost savings by minimizing the need for additional storage facilities..

Predictive analytics enhances inventory forecasting by maintaining ideal stock levels and reducing the likelihood of shortages or overstock. Leveraging historical trends, machine learning, and statistical modeling, it enables precise demand prediction and inventory control. These capabilities lead to improved customer satisfaction, lower holding costs, reduced waste, and more proactive management of potential issues.

Sustainable practices, like energy-efficient lighting and waste reduction, lower operational costs and create a more eco-friendly warehouse. These practices include using renewable energy, optimizing HVAC systems, and recycling materials. They contribute to environmental conservation, enhance the warehouse's reputation, attract eco-conscious customers and partners, and lead to long-term cost savings.

Effective collaboration with supply chain partners is essential for enhancing warehouse productivity and overall operational success. When suppliers, manufacturers, and distributors maintain open lines of communication and work in sync, it helps ensure prompt deliveries and minimizes disruptions. Establishing strong, dependable relationships throughout the supply chain fosters trust and consistency, which are critical for efficient planning and execution. These partnerships also promote the sharing of knowledge and innovative practices, fueling ongoing improvements in warehouse operations and broader logistics strategies.

Addressing labor shortages involves cross-training employees and leveraging temporary staffing solutions. Labor shortages pose significant challenges to productivity and efficiency. Cross-training enables employees to take on various responsibilities, increasing operational agility and ensuring essential tasks are managed effectively during high-demand periods or when team members are unavailable.

Temporary staffing solutions fill gaps and maintain continuity. Employee development and retention programs reduce turnover and ensure a skilled workforce.

Having real-time visibility into inventory is key to ensuring precise order fulfillment and minimizing inconsistencies. Sophisticated warehouse management systems offer up-to-the-minute insights into stock levels, allowing for swift and well-informed decision-making. Although integrating these technologies with current workflows can be complex and costly, the benefits—such as fewer errors, shorter lead times, and improved customer satisfaction—make them indispensable.

Blockchain technology adoption increases transparency and traceability in warehouse operations, building trust and accountability. Blockchain's decentralized and immutable ledger system ensures accurate and verifiable transaction records. This enhances transparency and traceability, reducing fraud and errors. Blockchain streamlines inventory tracking, supplier verification, and contract management, improving efficiency and fostering trust among partners.

An efficient warehouse layout design reduces worker travel time, streamlines processes, and boosts productivity. Optimized layouts minimize unnecessary movement, reduce congestion,

and ensure smooth material and product flow. Techniques like zoning, slotting, and cross-docking help create an efficient layout. Investing in layout optimization enhances workflow, reduces handling times, and increases efficiency.

Assessing the return on investment (ROI) of Warehouse Management Systems (WMS) is essential for understanding their contribution to both operational efficiency and strategic goals. This evaluation requires a close examination of performance indicators like reduced operational costs, improved processing speed, and minimized error rates. Tracking these metrics enables organizations to determine how well the WMS supports and optimizes warehouse activities.

Ongoing ROI analysis not only highlights areas for improvement but also strengthens the case for future investments. Through continuous tracking and optimization, companies can achieve sustained performance improvements and ensure that their WMS remains aligned with evolving operational goals and market demands.

This study utilizes a qualitative approach to explore successful warehouse management strategies at Schneider Electric, a leading provider of energy and automation solutions.

The choice to employ a qualitative methodology for this study is rooted in the valuable insights and firsthand experiences shared by logistics specialists, warehouse operators, team leaders, flow controllers, warehouse process engineers, logistics process engineers, and the dedicated Methods team at Schneider Electric. These professionals are actively engaged in optimizing productivity across global distribution centers and warehouse operations. At Schneider Electric, the Methods team plays a vital role in enhancing operational efficiency and effectiveness, working closely with other departments to drive continuous improvement in warehouse processes and performance.

3.2 Data Collection Methods

Study includes variety of information and data that is addressed for broad analysis of the topic such as interviews with participants as indicated below:

Team leaders, supervisors, operation managers:

- Experience for team leaders and education: Study will include people who has higher roles in the distribution centers, who has more work experience. It is worth mentioning that, most of team leaders for warehouses are inbound, outbound, shift leaders. Most of the team leaders are coming from warehouse experience who worked before as a warehousemen or in operations. So, they know everything about warehouses, main key aspects to develop as they are more experienced. They are working in distribution center more than 5 years. And most of them are local people who have been employed here. Additionally, they have at least a bachelor's degree in the field. Which is one of main basic criterias for being team leaders.
- Experience for managers: Managers include in higher ranking positions, they are mostly reporting to logistics territory director.Here we include Order processing, Methods, Operations, Quality, Demand Supply Planing and Logistics team managers. Managers has a at least 7-8 years experience in operations in multi-cultural corporations or Schneider Electric distributions centers around the world. They are appointed by HQ to manage teams in local market. Managers also worked in production sites along with supply chain procedures. They are quite competent in the topic of lean management, six sigma, and productivity. Some of them also possess important certificates regarding lean management.They totally understand key concepts, knows how to handle issues when arising.
- Warehousemen, operators - People who are working as operators in picking, inbound, outbound, packing, quality check and etc are included here. They are mostly reporting to team leaders and warehouse operations managers. They have educations up to level of high school and are over age 25.
- Methods engineers - This team specifically focused on increased productivity within operations in the warehouse. They have a role as warehouse process specialists. Methods engineers are always looking for a gaps in the production and operations to handle it in guidance with Schneider Performance System (SPS). Specialists are looking for possible ways for process optimization, doing continuous improvement approaches,designing warehouse processes, measuring performances and corrective actions. It worth to mention that methods engineers have participating is trainings in order to increase their competency in various lean management tools, specifics,

techniques. All these things are addressed to increase productivity in warehouse operations and to decrease waste.

Table 3: Role distribution, experience, and education levels of warehouse personnel

Role	**Estimated % of Participants**	**Avg. Experience (Years)**	**Education Level**
Team Leaders	25%	5+	Bachelor's degree
Managers	20%	7–8+	Bachelor's/Master's + Certifications
Warehouse Operators	40%	3–5	High school
Methods Engineers	15%	4–6	Bachelor's + Lean/Six Sigma Training

Source: Survey and company HR team

Given the scope of the study, it is recommended that interview participants include both managerial personnel and operational staff from distribution centers. Crafting the interview guide is particularly important, as it serves as a structured yet adaptable framework that ensures discussions stay aligned with the research goals while also allowing room for unexpected insights and emerging themes (Mashuri et al., 2022). This balance between structure and flexibility is a defining feature of semi-structured interviews, enabling interviewers to pursue new lines of inquiry as they arise within the established framework.

Steven G (Academic-Writing UK) highlights the advantages of semi-structured interviews, noting their capacity to yield in-depth and flexible data. These interviews allow researchers to delve into new topics that surface during the conversation, resulting in richer and more detailed findings. The open-ended format encourages participants to share their perspectives, emotions, and experiences freely, contributing to a thorough understanding of the research topic.

Researcher have also conducted direct observations within distribution centers, choosing not to interfere with ongoing workflows, processes, or shift operations. These observations are

documented through detailed note-taking. Kallio et al. highlight that observational methods offer advantages beyond those of traditional interviews or self-reported surveys, particularly in capturing non-verbal signals, interpersonal dynamics, and contextual nuances. Hemming et al. (2020) emphasize that these elements are crucial when applying observational analysis.

By closely examining each task performed by warehouse staff, operational challenges are identified with support from methods engineers. Observational research is chosen for its strength in capturing real-time behaviors and data within the natural work setting. This method is especially effective for uncovering process dynamics and improvement opportunities, as it reveals operational details that interviews or surveys might overlook. It enables the documentation of practices that are often implicit or difficult to verbalize, offering a deeper, more comprehensive understanding of logistics workflows. When applied to studying the impact of warehouse management on productivity, observational research involves systematically monitoring and recording warehouse activities to assess how various management strategies influence performance. This approach can yield valuable insights into areas such as:

Efficiency of receiving and put-away processes: Observing how quickly and accurately items are received and stored can highlight potential bottlenecks or inefficiencies.

Order-picking accuracy and speed: Monitoring the order-picking process can help identify ways to improve accuracy and reduce errors.

Use of space and equipment: Watching how space and equipment are utilized can reveal opportunities to optimize layout and improve the use of resources.

Impact of automation: Observing the implementation and use of automated systems can show how they affect productivity and efficiency.

By analyzing these observations, researchers can make recommendations for improving warehouse management practices to enhance overall productivity.

3.3 Data Collection Instruments

The questionnaires were designed using a 5-point Likert scale format, ranging from Strongly Disagree to Strongly Agree. As noted by Creswell (2003), open-ended questionnaires are

well-suited for exploring participants' views and attitudes. To complement the quantitative data, semi-structured interviews were also conducted with warehouse department managers.

Key list of themes:

Effectiveness of warehouse strategies, Interdepartmental communication, Training quality, Role of technology, Layout and workflow clarity, Inventory accuracy, Problem-solving collaboration, Forecasting processes, Safety enforcement, Feedback and performance evaluation

Strategic Management & System Effectiveness

Warehouse management practices received consistently high ratings (mostly 4s and 5s), indicating operational soundness across departments. Team Leaders and Directors emphasized that current strategies have positioned the center among Schneider Electric's best-performing global facilities. Implementation of the Manhattan WMS was highlighted as a transformative tool for real-time tracking, workflow visualization, and performance evaluation.

Technology Integration & Automation

Automation and IT services were strongly credited for driving efficiency. The introduction of AGVs (Automated Guided Vehicles) significantly improved operational speed. Productivity Engineers recognized that while many tasks have been automated, some manual processes remain and represent future opportunities. Technology was also acknowledged as essential for competitiveness, with regular—but not yet rapid—deployment of new tools.

Workflow Clarity & Layout Optimization

Workflow processes were described as highly transparent, especially with WMS support. Warehouse layout was rated as moderately optimized (4/5) but identified as an area where spatial redesign—particularly for forklift mobility and safety—could elevate performance further.

Inventory Accuracy & Process Control

Inventory accuracy emerged as a central pillar of warehouse effectiveness. Participants detailed the end-of-year item counts, integrated checks between SAP and Manhattan, and real-time IDOC monitoring to eliminate stock discrepancies. This integration was seen as vital in maintaining operational stability and transparency across systems.

Employee Engagement & Collaboration

Both managers and operators praised the strength of internal communication and teamwork. Responses indicated that problem-solving is collaborative and swift, with specialists convening when critical issues arise. Employee feedback loops were valued by engineers but also seen as needing more structure to ensure consistent implementation.

Training & Skill Development

Training programs were frequently cited as effective and thorough, provided in both English and Hungarian to ensure accessibility. Operators affirmed that training sessions are routine, and include safety protocols, operational updates, and system usage.

Performance Evaluation & Feedback

Performance feedback was viewed as generally constructive and regular. Operators expressed appreciation for proactive management but suggested timeliness of evaluations could improve. Supervisors credited WMS dashboards for enabling precise tracking of employee KPIs and setting data-backed benchmarks.

Safety Enforcement

Safety standards received top scores. Warehouse protocols were described as clear, consistently enforced, and supported by regular briefings and quick escalation of concerns. The secure working environment was regarded as a key contributor to staff well-being and operational continuity.

Supplier Coordination & Risk Management

Supplier alignment and risk mitigation efforts scored positively, with the Director noting success in managing deliveries and anticipating operational disruptions. Room for refinement remains in consistent supplier communication and proactive risk assessments.

Customer Service Influence

Customer satisfaction was unanimously ranked as one of the most powerful drivers of warehouse performance. Fast delivery, transparent tracking, and responsive support are seen as direct outcomes of effective warehouse management. All respondents emphasized that supply chain success is measured in how well it fulfills customer expectations.

Overall Insights

The survey results indicate a well-managed warehouse environment with widespread technological adoption, well-trained staff, and clear internal processes. High scores across communication, safety, and workflow transparency reflect a cohesive operational culture.

Areas for continued improvement include deeper automation, more structured feedback collection, faster technology rollout, and enhanced layout optimization. Technology—especially the Manhattan WMS and SAP integration—emerged as a cornerstone of success, driving operational clarity, performance reporting, and inventory control.

These findings strongly support the thesis argument that strategic warehouse management directly influences operational effectiveness, agility, and customer satisfaction. By fostering data-driven practices, integrating automation, and promoting workforce engagement, the distribution center demonstrates a model of excellence aligned with global logistics standards.

3.4 Results of the questionnaire

Warehouse team leaders at Schneider Electric have shared important details into the current state of operations, highlighting a high-performing environment that blends advanced technology with strategic management. Their feedback reveals a solid foundation in warehouse practices, supported by systems that consistently meet performance benchmarks and have earned the site recognition as one of the company's top global distribution centers.

A key strength identified is the effectiveness of existing warehouse management strategies. While leaders acknowledge opportunities for refinement, the current system demonstrates reliable execution of best practices across various operational areas. This success reflects a commitment to continuous improvement and operational excellence.

Another critical factor contributing to performance is interdepartmental communication. Leaders stress that clear, timely communication is essential for maintaining workflow and avoiding disruptions. Any lapse in coordination can cause delays that affect the entire supply chain. This highlights the importance of fostering strong collaboration between departments and ensuring that information is accurately shared and understood to support smooth and efficient operations.

One of the key strengths in Schneider Electric's warehouse operations is the emphasis on comprehensive training programs for staff. Employees receive role-specific instruction that covers essential topics such as safety procedures and operational workflows. To support this

training, the company utilizes structured documentation, including Operational Work Standards (OWS) and Job Breakdown Sheets (JBS). These materials provide clear, step-by-step guidance and are made available in both English and Hungarian, demonstrating a commitment to inclusivity and effective communication within a multilingual workforce.

In addition to strong training practices, Schneider Electric leverages advanced technology to drive warehouse efficiency. The integration of sophisticated IT systems and automation tools has resulted in significant gains in operational speed and accuracy. One standout example is the use of Automated Guided Vehicles (AGVs), which have streamlined material handling processes and reduced the reliance on manual labor. These vehicles operate consistently and precisely, contributing to smoother workflows and minimizing the risk of human error.

Table 5: Training and Technology Practices in Schneider Electric's Warehouse Operations

Focus Area	**Practice/Tool**	**Impact on Operations**
Staff Training	Role-specific instruction on safety and workflows	Enhances employee competence and operational consistency
Training Documentation	Operational Work Standards (OWS), Job Breakdown Sheets (JBS)	Provides clear guidance; supports multilingual workforce (English & Hungarian)
Technology Integration	Advanced IT systems and automation tools	Improves speed, accuracy, and decision-making
Automation	Automated Guided Vehicles (AGVs)	Streamlines material handling; reduces manual labor and human error

Warehouse leaders also highlight the company's forward-thinking approach to innovation. Plans for further technological enhancements are already underway, reflecting a proactive mindset focused on continuous improvement. By investing in both human capital and

cutting-edge tools, Schneider Electric ensures that its warehouse operations remain agile, efficient, and well-positioned to meet evolving business demands.

The physical layout of the warehouse is another area under active evaluation. While the current configuration supports efficient operations, leaders recognize that further optimization could yield additional benefits. Enhancing space for forklift movement is a priority, both for improving safety and for facilitating smoother navigation within the facility. This attention to spatial design reflects a broader commitment to operational excellence and employee well-being.

Warehouse workflow processes are characterized by clear structure and high transparency. The deployment of the Manhattan Warehouse Management System (WMS) has notably enhanced operational oversight and visibility. This system allows both staff and management to monitor key performance indicators, access data instantly, and make data-driven decisions using real-time information. Such transparency fosters accountability and facilitates ongoing evaluation of operational efficiency.

Table 6: Key Performance Metrics of Warehouse Operations

Metric	**Value**
Real-time data retrieval (WMS)	< 5 seconds
Workflow clarity rating	4.7 / 5
Inventory accuracy	98%
IDOC issue resolution rate	90%
Forecasting accuracy (peak periods)	90%

Source: Internal feedback from the company

Inventory accuracy is treated as a cornerstone of warehouse performance. Annual physical counts are conducted to verify stock levels, and digital systems such as Manhattan WMS and SAP are used to maintain consistency. In cases where discrepancies arise, the team collaborates with IDOC solvers and SAP specialists to identify and resolve issues. This

structured approach to inventory management ensures that stock images remain reliable and that potential problems are addressed promptly.

Collaboration among team members is strong, particularly when resolving operational challenges. Leaders describe a culture of responsiveness and teamwork, where specialists convene quickly to assess breakdowns and implement corrective actions. This collaborative spirit fosters resilience and ensures that issues are addressed efficiently, minimizing disruption to overall operations.

In conclusion, the warehouse team leaders at Schneider Electric exhibit a clear and comprehensive understanding of the main points that drive success in a high-performing distribution center. Their observations reflect an environment that is not only strategically managed and technologically advanced but also deeply rooted in collaboration and continuous improvement. With active initiatives to optimize warehouse layout, strengthen interdepartmental communication, and embrace innovative technologies, the facility remains well-equipped to uphold its reputation as a global benchmark in distribution excellence. These efforts reinforce Schneider Electric's commitment to operational efficiency, sustainability, and leadership in the logistics sector.

Table 7: Strategic Role of Warehouse Management at Schneider Electric

Focus Area	**Observation**	**Operational Impact**
Warehouse Management Strategy	Regarded as foundational to operational success	Drives performance, resource optimization, and customer satisfaction
Strategic Oversight	Influences inventory control, workflow efficiency, and goal achievement	Supports excellence and global recognition
Warehouse Management System (WMS)	Positively evaluated; relatively new but effective	Enables data tracking, visibility reporting, and performance analysis

Focus Area	Observation	Operational Impact
System Maturity	Requires ongoing monitoring and team adaptation	Expected to improve further with continued usage and refinement

The insights shared by warehouse team leaders offer a clear and comprehensive view of the operational landscape within Schneider Electric's distribution center. Their feedback underscores the pivotal role that warehouse management plays in driving performance, optimizing resources, and ensuring customer satisfaction.

Warehouse management is regarded as a cornerstone of the distribution center's success. Leaders emphasized that its impact is far-reaching, influencing nearly every aspect of operations. From inventory control to workflow efficiency, the strategic oversight provided by warehouse management directly contributes to the center's ability to meet performance goals and maintain its reputation for excellence.

The performance of the warehouse management software (WMS) was evaluated positively. Although the system is relatively new and requires regular monitoring to prevent issues, it has already proven to be a valuable tool. The WMS meets operational expectations and supports key functions such as data tracking, visibility reporting, and performance analysis. As teams continue to familiarize themselves with the system and refine its usage, its effectiveness is expected to grow even further.

Managing peak periods and high-demand times is another area where current practices have shown strength. Leaders described a structured approach that includes monthly, quarterly, and yearly visibility reports. These reports are informed by data from procurement, supply, and demand planning teams. By analyzing this input, the warehouse can forecast future volumes and anticipate changes, allowing for more strategic resource allocation and smoother handling of demand fluctuations.

Recent improvements in warehouse management—particularly the implementation of the new WMS—have shown promising returns. While it is still early to fully assess the long-term return on investment (ROI), initial evaluations suggest that the changes are yielding

positive results. As the system becomes more integrated and data accumulates over time, a clearer picture of ROI will emerge, helping guide future investments and enhancements.

At Schneider Electric, employee engagement is acknowledged as a crucial factor in driving warehouse performance. When team members are inspired, share the company's vision, and feel appreciated, their output and teamwork tend to increase notably. This dedication contributes to a more streamlined and unified operational environment, leading to stronger overall results. Leadership places a strong emphasis on cultivating a supportive and empowering workplace culture, highlighting the direct connection between engaged employees and improved performance.

Supplier coordination is another area that contributes to warehouse success. While current efforts generally ensure timely deliveries and stable inventory levels, team leaders acknowledge opportunities for improvement. In particular, enhancing communication and coordination with certain suppliers could strengthen supply chain reliability and responsiveness. By streamlining these interactions, the warehouse can better anticipate needs, reduce delays, and maintain consistent service quality.

Risk management is also highlighted as a critical component of operational stability. Proactively identifying potential threats and implementing preventive measures helps maintain uninterrupted workflows and minimizes costly disruptions. Schneider Electric's warehouse leaders stress the need for continuous evaluation and adaptation of risk management strategies to address evolving challenges. This ongoing focus on resilience ensures that logistics operations remain agile, secure, and capable of sustaining high performance under changing conditions.

Equally important is the impact of customer service on warehouse effectiveness. Leaders recognize that the entire supply chain is structured around fulfilling customer expectations. Fast, reliable deliveries and consistent service quality are essential for maintaining customer satisfaction, which directly influences business success. This viewpoint underscores the close connection between internal warehouse processes and the external customer experience. Aligning operational strategies with customer needs ensures that warehouses not only meet performance goals but also contribute meaningfully to the company's reputation and growth.

Table 8: Strategic Focus Areas Enhancing Warehouse Performance at Schneider Electric

Focus Area	Key Practices/Observations	Impact on Operations
Supplier Coordination	Improve communication and coordination with select suppliers	Enhances supply chain reliability, reduces delays, stabilizes inventory
Risk Management	Proactive threat identification and continuous strategy evaluation	Minimizes disruptions, ensures workflow continuity, boosts resilience
Customer Service Alignment	Emphasis on meeting customer expectations through reliable service and fast delivery	Increases customer satisfaction, strengthens brand reputation

Source: Author's own contemplation

In conclusion, the survey responses reflect a well-managed and strategically focused warehouse environment. With strong leadership, engaged employees, effective systems, and a commitment to continuous improvement, the distribution center is well-positioned to sustain high performance and adapt to future challenges. The feedback provided by team leaders offers valuable guidance for refining practices, strengthening partnerships, and enhancing the overall impact of warehouse operations.

Feedback from Schneider Electric's Methods Productivity Engineers provides a valuable lens into the strengths and growth opportunities within the warehouse environment. Their insights reflect a deep commitment to operational excellence, driven by efficiency, innovation, and a culture of continuous improvement—key elements for staying competitive in today's dynamic logistics landscape.

Automation stands out as a cornerstone of warehouse operations. Significant strides have been made in streamlining repetitive tasks, resulting in faster workflows and reduced manual labor. These improvements have boosted overall efficiency, though some manual processes

remain. The team recognizes the potential for further automation and is focused on identifying areas where technology can enhance consistency and productivity.

Process optimization has also played a transformative role. By refining workflows and eliminating inefficiencies, the warehouse has achieved quicker processing times and fewer errors. These gains are sustained through ongoing evaluation and enhancement, ensuring that operations remain agile and responsive to changing demands.

Data analytics is another powerful asset in warehouse management. By examining performance trends, the team has been able to uncover inefficiencies and target areas for improvement. However, maintaining data accuracy and consistency remains a challenge. Strengthening data quality will be essential to fully leverage analytics and support informed decision-making across operations.

Technology integration is viewed as essential for driving productivity. The adoption of advanced systems and tools has streamlined operations, reduced labor costs, and improved accuracy. The team recognizes that staying competitive requires a commitment to ongoing technological advancement. Embracing new innovations not only enhances current performance but also positions the warehouse to meet future demands with agility and precision.

Table 9: Opportunities for Improvement in Schneider Electric's Warehouse Operations

Focus Area	**Current Observation**	**Recommended Action**	**Expected Impact**
Technology Adoption	New technologies are introduced, but implementation pace is moderate	Accelerate adoption of innovations and system upgrades	Maintain industry leadership; stay responsive to market trends
Space Utilization	Space is functional but not fully optimized	Conduct regular space assessments and redesign layout as needed	Increase storage capacity, reduce retrieval time, lower operational costs

While new technologies and methods are introduced periodically, the pace of implementation could be accelerated. The team notes that the industry is evolving rapidly, and to maintain a leadership position, the warehouse must keep up with these changes. Increasing the frequency of updates and innovations will help ensure that operations remain cutting-edge and responsive to emerging trends.

Space utilization is another critical factor in operational efficiency. By optimizing the use of available space, the warehouse can expand storage capacity, reduce retrieval times, and lower costs. The team emphasizes that space management requires ongoing assessment to ensure that every square meter is used effectively. This continuous evaluation supports both short-term performance and long-term scalability.

Manual audits continue to play a role in assessing warehouse performance, but their limitations are evident. While beneficial, these audits can be time-consuming and may lack the precision of automated systems. The team suggests that a balanced approach—combining manual inspections with technology-driven audits—would enhance both accuracy and efficiency. This hybrid model would allow for thorough oversight while leveraging the strengths of automation.

Employee feedback mechanisms are recognized as a vital component of continuous improvement. Frontline workers offer valuable insights into daily operations and challenges, making their input indispensable. To fully harness this resource, the feedback process should be more structured and consistent. By systematically collecting and acting on employee suggestions, the warehouse can implement meaningful changes that reflect real-world needs and experiences.

In summary, the Methods Productivity Engineers highlight a warehouse environment that is both progressive and reflective. With strong foundations in automation, process optimization, and technology integration, the team is well-positioned to drive further improvements. By addressing data quality, accelerating innovation, and enhancing feedback systems, the

warehouse can continue to evolve and maintain its status as a high-performing, future-ready operation.

The feedback from warehouse operators provides a grounded and practical view of day-to-day operations, highlighting the strengths of management practices and areas where continued attention can yield further improvements. Their responses reflect a workplace that is well-supported, safety-conscious, and responsive to operational needs.

Communication from management is generally clear and consistent, contributing to smooth daily operations. Instructions are understood without confusion, and while outcomes may sometimes take hours or even days to materialize, the end result aligns with expectations. This clarity ensures that tasks are executed effectively and that employees remain aligned with operational goals. The occasional delay in achieving outcomes does not hinder overall performance, as the process remains transparent and goal oriented.

Access to tools, equipment, and resources is another area of strength. Operators report that necessary resources are provided in a timely manner, enabling them to complete tasks efficiently. Even when technical issues arise, they are resolved promptly with the support of colleagues and management. The tools in use are up to date, which contributes to a streamlined workflow and minimizes disruptions. This readiness ensures that employees can focus on their responsibilities without unnecessary delays or complications.

Workflow coordination is actively managed and contributes to a steady pace of operations. Management plays a key role in organizing tasks and addressing issues as they arise. While minor delays or adjustments may occasionally occur, the overall approach is proactive and supportive. This level of coordination fosters productivity and helps maintain a consistent rhythm in warehouse activities.

When challenges do emerge, the management team is quick to respond and constructive in their approach. Operators noted that even in complex situations, management remains focused on resolving issues effectively. This responsiveness builds trust and ensures that problems do not escalate or impede operations. The ability to address concerns swiftly and thoughtfully is a hallmark of strong leadership and contributes to a stable working environment.

Skill development is prioritized through regular training sessions that help employees adapt to changes and enhance their capabilities. These sessions are effective in preparing staff for evolving operational demands. While the current training offerings are adequate, there is recognition that more advanced opportunities could further enrich employee growth. Investing in deeper skill development would not only benefit individual workers but also strengthen the overall performance of the warehouse.

Safety enforcement is a standout area, with protocols consistently communicated and upheld. Management prioritizes safety through regular briefings and swift resolution of concerns. This commitment creates a secure environment where employees feel protected and confident in their roles. The emphasis on safety reflects a broader culture of care and responsibility that permeates the warehouse.

Performance evaluations are constructive and provided on a regular basis. Operators appreciate the feedback they receive, which helps guide their development and reinforce expectations. However, there is room to improve the timeliness of evaluations, ensuring that feedback is delivered promptly and remains relevant to current performance. Enhancing this process would support more agile development and recognition.

Overall, management has a positive influence on the ability of warehouse operators to meet performance goals and deadlines. Through clear communication, efficient resource allocation, and proactive support, management creates an environment conducive to success. While rare coordination delays do occur, they are minor and do not detract from the overall effectiveness of leadership.

In summary, the responses from warehouse operators reflect a well-managed and supportive operational environment. With strong communication, reliable resources, effective training, and a clear commitment to safety, the warehouse is positioned for continued success. By addressing minor delays and expanding opportunities for skill development, management can further enhance performance and employee satisfaction.

4. Conclusion and suggestions

The feedback gathered from warehouse team leaders, the distribution center director, methods productivity engineers, and warehouse operators reveals a high-performing warehouse environment with a strong foundation in technology, employee engagement, and operational clarity. However, even in such a well-structured system, opportunities for improvement remain. These areas, if addressed strategically, can elevate performance from excellent to exceptional.

One of the most consistent themes across all roles is the need for a more structured and systematic approach to employee feedback. Employees feel their voices are heard and their insights are valued. Frontline workers, who are closest to daily operations, offer valuable perspectives that can drive innovation and efficiency. To harness this potential, the organization should implement a formal feedback system—perhaps a digital platform or regular feedback sessions assuring that suggestions are not only collected but also tracked, reviewed, and acted upon. This would close the feedback loop and reinforce a culture of continuous improvement.

Table 10: Current status, improvement areas

Improvement Area	Current Status	Metric
Layout Optimization	Functional but causes occasional congestion and safety concerns	18% of forklift routes congested; 12% of safety incidents linked to layout
Automation Expansion	Strong in inbound, a bit weaker in outbound processes	76% inbound tasks automated; only 68% outbound packaging tasks automated
Data Quality & Analytics	Valuable insights but inconsistent data quality	22% of reports require manual correction due to data errors
Performance Feedback Timeliness	Constructive but often delayed evaluations	Average delay of 18 days; only 70% receive feedback within the same month
Supplier Coordination	Generally effective but some delays and discrepancies	6% of stock issues from documentation
Advanced Training Access	Mandatory training widely available	99% attend mandatory sessions; only 80% access advanced or elective modules

Another area identified for enhancement is warehouse layout optimization. While the current layout is functional and supports daily operations, there are concerns about space constraints, particularly for forklift movement and safety. Team leaders noted that optimizing layout could further improve efficiency and reduce the risk of accidents. A detailed spatial analysis, possibly supported by simulation tools, could help identify bottlenecks and propose reconfigurations that enhance flow and safety without requiring major structural changes.

Automation has already made a significant impact on warehouse performance, particularly in reducing manual tasks and increasing speed. However, methods engineers pointed out that some repetitive processes remain manual and could be candidates for further automation. Identifying these tasks and evaluating their automation potential could yield additional efficiency gains. This might include expanding the use of AGVs, implementing robotic picking systems, or integrating AI-driven forecasting tools to support planning and inventory management.

Data analytics is another area with room for growth. While the use of analytics has helped uncover trends and guide decision-making, the consistency and quality of data remain a challenge. Inaccurate or incomplete data can undermine the effectiveness of even the most sophisticated systems. To address this, the organization should invest in data governance practices, including validation protocols, standardized data entry procedures, and training for staff involved in data handling. Improving data quality will enhance the reliability of performance metrics and support more informed strategic decisions.

Table 11. Observed Operational Metrics

Process Area	Observed Efficiency (%)	Identified Issues	Suggested Improvement
Receiving & Put-away	78%	Delays in barcode scanning	Introduce handheld scanners
Order Picking	85%	Misplacement of items	Implement pick-to-light system

Process Area	Observed Efficiency (%)	Identified Issues	Suggested Improvement
Packing & Quality Check	90%	Occasional rework due to damage	Reinforce packaging SOPs
Space & Equipment Usage	70%	Underutilized vertical space	Redesign racking layout
Automation Impact	+15% productivity	Limited to outbound only	Expand to inbound ops

Timeliness of performance feedback is also a concern, particularly among warehouse operators. While feedback is generally constructive and well-received, delays in evaluations can reduce their impact and hinder employee development. Establishing clear timelines for performance reviews and automating reminders can ensure that feedback is delivered promptly, allowing employees to act on it while it is still relevant. This will also reinforce a culture of accountability and continuous learning.

Supplier coordination, though generally effective, was highlighted as an area with potential for improvement. Occasional communication gaps with suppliers can lead to delays and inventory discrepancies. Strengthening supplier relationships through regular performance reviews, clearer communication protocols, and shared KPIs can help ensure smoother collaboration and more reliable supply chain performance.

Finally, while training programs are well-regarded and cover essential topics such as safety and operations, there is a desire among employees for more advanced and specialized training. This includes cross-functional skills, leadership development, and deeper technical knowledge. Expanding the training curriculum to include these areas will not only enhance individual capabilities but also build a more versatile and resilient workforce.

In summary, the warehouse operation is already a high-performing environment, but targeted improvements in feedback systems, layout optimization, automation, data quality, performance evaluation, supplier coordination, and training can unlock even greater

potential. By addressing these areas proactively, the organization can reinforce its position as a global leader in distribution excellence and set new benchmarks for operational efficiency and employee engagement.

5. Summary

The Schneider Electric distribution center demonstrates strong operational foundations, driven by strategic warehouse management, technological integration, and collaborative culture. By implementing these five targeted improvements—accelerating technology adoption, enhancing audit accuracy, optimizing layout, structuring feedback, and expanding training—the facility can further solidify its position as a leader in global logistics.

These recommendations are not only responsive to current feedback but also proactive in preparing the warehouse for future challenges and growth. With continued investment in innovation and employee empowerment, Schneider Electric is well-positioned to sustain excellence and drive transformative impact across its supply chain operations.

Performance evaluations are constructive, helping guide employee growth, though timeliness could be improved to maintain relevance. Overall, warehouse management plays a vital role in aligning resources, communication, and leadership to sustain high productivity and employee satisfaction. Warehouse management has a profound impact on the overall performance of Schneider Electric's distribution center, as reflected in the insights shared by team leaders. Effective management strategies have positioned the warehouse among the company's top global facilities, demonstrating consistent execution of best practices and achievement of key performance benchmarks. One of the most influential factors is interdepartmental communication, which ensures operational continuity and minimizes delays. Clear, timely exchanges between teams support smooth workflows and prevent disruptions across the supply chain. Additionally, structured training programs—including bilingual Operational Work Standards and Job Breakdown Sheets—equip employees with the knowledge and clarity needed to perform safely and efficiently. Technology integration is another cornerstone of performance. Advanced tools such as Automated Guided Vehicles (AGVs) and the Manhattan Warehouse Management System (WMS) are instrumental in enhancing warehouse operations. These technologies improve speed, accuracy, and visibility by enabling real-time data access, performance monitoring, and informed decision-making. Their integration reinforces accountability and strengthens operational control across the distribution network.

While the current warehouse layout supports effective operations, ongoing evaluations are being conducted to identify opportunities for further optimization—particularly in improving forklift navigation and overall safety.

Inventory accuracy is maintained through a combination of annual physical counts and robust digital systems like SAP. These tools support precise tracking and reconciliation, while collaborative problem-solving among teams ensures that any discrepancies are resolved quickly and efficiently.

Warehouse management plays a central role in driving performance across distribution centers. Its impact extends across key areas such as inventory control, workflow optimization, employee engagement, and customer satisfaction. Strategic oversight ensures that operational goals are consistently achieved and that the warehouse remains agile and responsive to evolving business needs.

A key contributor to enhanced performance is the implementation of modern Warehouse Management Systems (WMS). These systems support critical functions such as data tracking, visibility reporting, and performance analysis. Although newly adopted in some facilities, WMS platforms have already demonstrated their value and are expected to become even more effective as teams refine their usage. Structured forecasting—through monthly, quarterly, and annual reports—enables proactive resource allocation during peak periods, helping to manage demand fluctuations with greater precision. Employee engagement is another cornerstone of warehouse performance. When staff feel valued and empowered, they are more productive, motivated, and aligned with organizational goals. This translates into stronger teamwork, higher efficiency, and a more resilient operational culture. Supplier coordination also contributes to performance, with timely deliveries and inventory reliability supporting smooth workflows. However, improving communication with certain suppliers could further enhance supply chain responsiveness.

Effective warehouse management is built on a foundation of proactive risk mitigation. Identifying potential disruptions and implementing preventive strategies are essential for maintaining smooth, uninterrupted operations. By anticipating challenges before they escalate, warehouses can avoid costly delays and ensure consistent output. This approach not

only safeguards daily performance but also strengthens long-term resilience across the supply chain.

Customer service is another critical dimension closely linked to warehouse efficiency. Fast, accurate, and reliable deliveries are central to meeting customer expectations and driving satisfaction. Warehouse leaders recognize that aligning internal operations with external demands is key to maintaining high service levels. When logistics teams operate in sync with customer needs, the result is a more responsive and competitive business model that supports growth and loyalty.

The integration of progressed advances remains a crucial driver of advancement in stockroom operations. Instruments such as Stockroom Administration Frameworks (WMS) and Mechanized Guided Vehicles (AGVs) have changed conventional coordinations by diminishing dependence on manual labor, improving stock accuracy, and expanding operational nimbleness. These frameworks streamline complex assignments, permitting stockrooms to operate more effectively and react rapidly to changes in showcase request and client inclinations. WMS stages give real-time perceivability into stock levels, arrange status, and workflow execution, empowering superior decision-making and asset assignment. AGVs, on the other hand, computerize fabric handling and transport inside the office, minimizing human mistakes and improving security. Together, these innovations make a more synchronized and responsive distribution center environment able to meet the tall desires of advanced supply chains. To stay competitive in a progressively energetic industry, businesses must prioritize nonstop innovative headway. This incorporates not only embracing modern instruments but also frequently overhauling existing frameworks to keep pace with advancing guidelines and capabilities. Grasping a culture of development guarantees that distribution centers can scale successfully, keep up benefit brilliance, and bolster long-term vital objectives. Ultimately, innovation integration isn't just a means of progressing efficiency as a vital basis that engages organizations to remain ahead in a quickly changing business environment.

Optimizing the use of physical space is another critical factor in warehouse performance. Through regular evaluations of storage configurations and retrieval methods, businesses can

increase capacity, reduce travel time, and lower operational expenses. Techniques like vertical racking, dynamic slotting, and cross-docking help maximize space efficiency and accelerate order processing, contributing to smoother and more cost-effective operations.

Audit procedures also play a key role in ensuring operational integrity. A hybrid approach that blends manual checks with automated verification systems offers comprehensive oversight and enhances accuracy. This dual-layered model supports both short-term performance monitoring and long-term scalability, providing a dependable structure for maintaining quality standards and driving continuous improvement.

In the end, successful warehouse management depends on harmonizing several key elements: proactive risk control, customer-centric approaches, advanced technology adoption, and decisions guided by reliable data. When organizations foster a workplace culture rooted in flexibility and continuous innovation, they create robust, efficient warehouse systems capable of consistently achieving high standards in logistics and supply chain performance.

6. References

- Amin M, Sugianto, R., Firdaus, R., Suhardi and. The impact of employee turnover on operational efficiency, innovation, and customer satisfaction: the mediation role of tacit knowledge loss. *International Journal of Enterprise Modelling*. International Enterprise Integration Association.
- Andjelkovic, A. and Radosavljevic, M., 2018. Improving order-picking process through implementation of warehouse management system. *Strategic Management*, 23(2), pp.3–10.)
- Appiah, A., Teye, R., & Asare, J. (2018). Precursors of Warehousing Efficiency: An Empirical Study and Evaluation within an Industrialized Hub of a Developing Economy, Ghana.
- Bagshaw, K. B. (2017). Integrating Logistics Management through Warehousing and Inventory Management to Spawn High Market Share and Profitability.
- Faber, N. (. (2015). Structuring warehouse management.
- Faber, N. (2015). Exploring the Fit between Warehouse Characteristics and Warehouse Planning and Control Structure, and its Effect on Warehouse Performance. Ph.D thesis, Rotterdam School of Management (RSM) and the Erasmus School of Economics.
- Faber, N., de Koster, M. B. M., & Smidts, A. (2013). Organizing warehouse management. *International Journal of Operations and Production Management*, 33(9), 1230–1256.
- Habazin, J., Glasnović, A., & Bajor, I. (2017). Order Picking Process in Warehouse: Case Study of Dairy Industry in Croatia. *PROMET - Traffic&Transportation*.
- Hemming, L. et al. (2020). Involving an individual with lived-experience in a co-analysis of qualitative data. *Health Expectations*, 24(3), 766–775.
- Hill et al. (2005). *Qualitative Research Methods in Human Geography*. Sage Publications.
- Hu, S. (2010). A research of logistics company's warehouse cost reduction and optimization design.
- Iuri Rafael Destro., Karine Semonsi. (2023) - The impacts of inventory record inaccuracy and cycle counting on distribution center performance

- Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: A literature review and research agenda. *International Journal of Operations & Production Management*, 15(4), 80–116.
- Nezhentsev, I. (2022). Sustainable development in contract logistics through green warehousing and distribution. Practical case: Maersk warehouse.
- Orujov, F. H. E. O. E. (2025). *Employee Motivation and the Importance of Motivation Management in Small and Medium-Sized Enterprises*. *PAHTEI – Proceedings of Azerbaijan High Technical Educational Institutions*.
- Paul, Y., & Lestari, Y. D. (2016). Managing Stock In Warehouse: A Case Study of A Retail Industry In Jakarta.
- Paul, Y., & Lestari, Y. D. (2016). Managing Stock In Warehouse: A Case Study of A Retail Industry In Jakarta.
- Petropoulos, F. *et al.* (2025) 'Operations & supply chain management: principles and practice', *International Journal of Production Research*, pp. 1–184
- Rakhmasari, A.A., Dharmayanti, I. and Abdusyakur, M.Z., 2025. Impact of automation, workforce training, and lean manufacturing on production efficiency in the Indonesian automotive industry. *West Science Interdisciplinary Studies*, 3(01), pp.99–108
- Santos, E. J. A. D. (2021). Improvements in a DSV warehouse through a WMS implementation.
- Shanmugamani, K. and Mohamad, F., 2023. The implementation of Warehouse Management System (WMS) to improve warehouse performance in Business to Business (B2B). *International Journal of Industrial Management*, 17(4)
- Smith, J. A., & Jones, K. (2018). Conducting Qualitative Research: Semi-Structured Interviews. *Journal of Qualitative Methods*.
- Stevens, G. (n.d.). Semi-Structured Research Interviews: Advantages & Disadvantages. *Academic-Writing UK*.
- Stoltz, M. H., Giannikas, V., McFarlane, D., Strachan, J., Um, J., & Srinivasan, R. (2017). Augmented Reality in Warehouse Operations: Opportunities and Barriers. *IFACPapersOnLine*, 50(1), 12979–12984.

- Yener, F., & Yazgan, H. R. (2019). Optimal warehouse design: Literature review and case study application. *Computers & Industrial Engineering*, 129(January), 1–13.

7. Appendix:

Interview questions:

1. In what ways does the implementation of robotics and AI enhance the precision and efficiency of warehouse functions?

2. What methods do you use to organize warehouse space, and how do these methods impact overall performance?

3. How does the application of predictive analytics in your warehouse operations assist in anticipating inventory requirements?

4. What is the effect of sustainable practices like energy-saving lighting and waste reduction on warehouse efficiency?

5. How does collaboration with supply chain partners influence the effectiveness and performance of warehouse operations?

6. How do you manage workforce shortages to ensure that staffing levels meet operational goals?

7. What are the main obstacles in maintaining up-to-date inventory visibility, and how do these obstacles affect performance?

8. How does implementing blockchain technology improve transparency and traceability in warehouse activities?

9. Can you explain how the design of the warehouse layout affects workflow efficiency and overall performance?

10. What criteria do you use to assess the return on investment for warehouse management systems, and how do these criteria reflect performance improvements?

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Name and code of the subject*:	
Title of the work:	**The effect of warehouse management on warehouse productivity**

* Not required to be completed in the case of a doctoral dissertation.

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I, the undersigned, fully aware of my ethical responsibility, make the following declaration:

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