

**THE IMPACT OF USING ARTIFICIAL INTELLIGENCE
TOOLS IN MAXIMIZING
THE EFFICIENCY OF OPERATIONS IN WAREHOUSE
MANAGEMENT**

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Abstract: The adoption of machine learning and high advanced technologies in most of the organizations and companies becomes a critical role. This fact is most obvious in the multinational companies and even domestic companies that work in production, supply chain and logistics.

This is due to the fact that technologies and computer machines become more dependable by human beings for their fast responsiveness, more intelligent and deep thinking. Also, those high standard computer technologies have many features that contribute in minimizing the cost of running the different business activities and the fast execution of required tasks. These technologically high advanced systems have revealed clear benefits and gains from being implemented in the warehouse management systems. On the other hand, there are some fears and challenges for the wide use of those fast developed technologies, especially the artificial intelligence. Some computer science specialists argue that the machine and the highly advanced artificial intelligence tools may have bad effects on different areas of businesses. Also, there are some challenges of implementing those techniques in the warehouse management systems. Therefore, in this research paper we explain the artificial intelligence effect on warehouse management operations and activities, by showing the features of traditional warehouse activities and the efficiency of operations of modern and AI-driven warehouses. Also, this article exposes the fears and challenges that face the same and conclude with some recommendations.

Keywords: AI in Logistics – AI Benefits in Warehouse management – Effects of AI tools in warehouse activities – Enhancing business operations through AI – Risks of AI in Warehouse Management – Challenges of AI Tools & Applications in Warehouse Operations.

JEL codes: 033, M11

Research aim: the article aim is to show the importance of artificial intelligence in warehouse management operations and activities and how the implementation of those highly advanced technologies can maximize the efficiency of warehouse operations.

Research novelty: the research novelty is presented in highlighting the significance of new technological trends adoptions and the challenges that may occur due to the implementation of AI tools and applications.

Introduction

Warehouse management is one of the most significant managements in each organization and company; especially for those working in the field of production, distribution and fast-moving consumable goods. These kinds of industries require a strong warehouse management system in order to achieve company goals and objectives to the level of reaching maximizing customer satisfaction levels.

At the same time, traditional warehouse systems suffer from shortages in delivering the target outcomes due to the lack of applying technology and depending totally on human efforts, human mentality and paper-sheet data records. Therefore, warehouse managers have started to seek accuracy, speed and utilization to implementing new and modern technologies to support in running warehouse operations with high flexibility ratios.

All these indications motivate directors and leaders to adopt AI-technologies in their warehouse operation systems and which in return to lead to significant efficiency both on the operational level and on financial level as well. So, this paper sheet will highlight the efficiency of applying AI in warehouse operations in figures, reflecting the benefits thereof.

Research Results

1- Traditional Warehouse Management System

Traditional warehouse management system is a type of managerial system that is being used by in the traditional warehouses. Traditional warehouses, here, mean warehouses in which the warehouse management depends on traditional approaches to carry out the WH activities and business operations. Traditional warehouse also uses manual process and manual equipments without extensive automation or advanced technology.

Thus, traditional warehouse is indicated in the traditional approach through which activities and operations in the warehouse are carried out. Such operations and activities can be represented in manual order handling, manual order picking. Also, tools and machines used in the traditional warehouse are operated by humans, manual movement of goods, manual material handling. At the same time, workers use traditional equipment's such as forklifts, pallet jacks and hand carts to move goods within the warehouse spaces area. In addition to that, loading and unloading of trucks and containers are carried out manually. From the flexibility and storage space utilization perspective, there is limited utilization due to the reliance on manual labour and old systems.

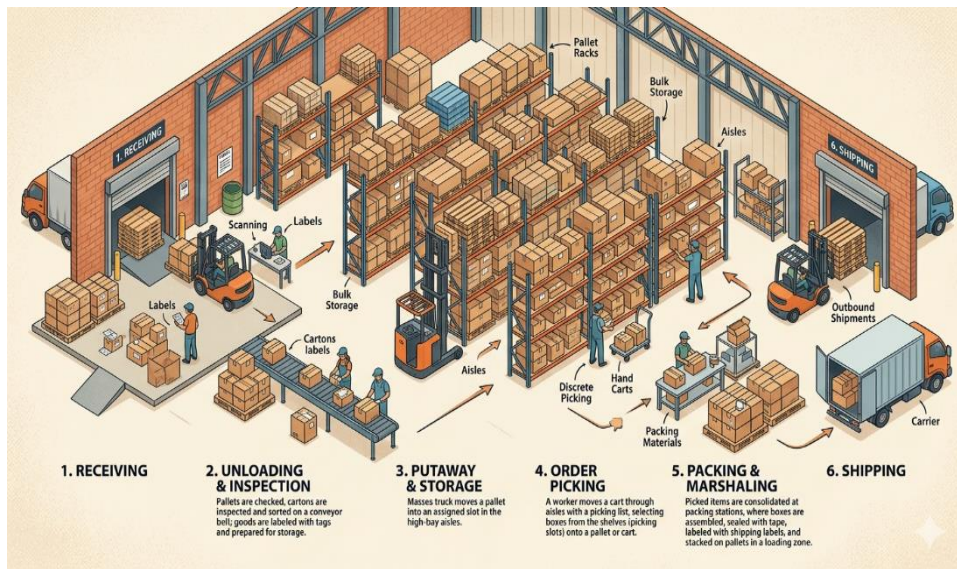


Figure 1 (Created by Researcher: Showing the normal process of traditional warehouse management)

On the other hand, there are a lot of disadvantages that organizations face due to keeping work with old traditional warehouse management systems. Those disadvantages include material handling high costs, inefficient operations and workflow bottlenecks, negligence and damaged materials, inefficient space management and inefficient material handling equipment. Therefore, those challenges may lead to high volume costs of the company and reduce profitability from another key pillar of view (Olumide F. Odeyinka and Olumide G. Omoegun, 2023)

2- Modern & AI-Driven Warehouse Management Systems:

Due to the disadvantages of traditional warehouse management systems that require much human being efforts when it comes to things like counting inventories, picking orders and data inputs, more technological techniques in the industry have been gradually developed. Some of those techniques are like using W/H system such as ERP, bare-coding, Radio- Frequency identification. The efficiency of such uses has led to minimizes the operations mistakes. At the same time, the consequences that driven from the use of traditional WH techniques led the WH managers and leaders to seek another technological advanced tool to avoid negative impacted results such as backorders, over stock situation which led to WH management high cost decreasing profitability and customer dissatisfaction (Sara Al-Azizy, 2024).

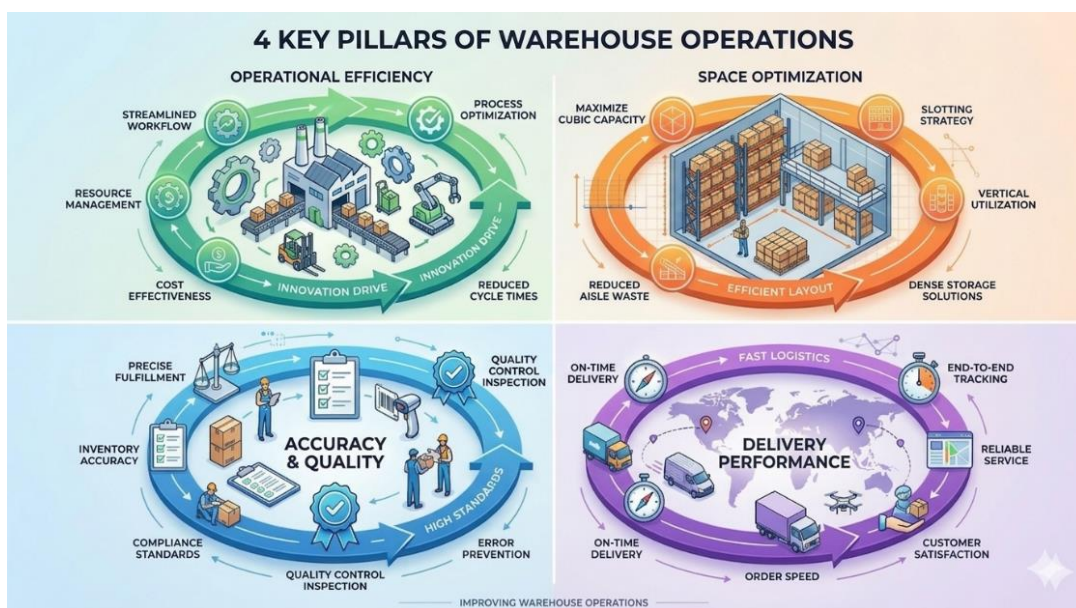


Figure 2 (Created by Researcher, Showing the 4 key pillars of warehouse operations)

Therefore, the main goal of implementing automation in warehouse operations is to reduce time cycle and to maximize speed of operation processes. This will be reflected positively on the overall logistics cycle in order processing, shipment tracking, and inventory management because it drives out human errors and increase operational velocity (Omar Abdullahi, 2025). This automated system is practically implemented through the 4

warehouse key pillars, operation efficiency, delivery management, space utilization and quality.

Thus, Warehouse Management System (WMS) is a computer system that reduces warehouse process complexity through machine learning. As the studies state, WMS is used to support the needs of the supply chain, including activities such as distribution and manufacturing. This is always user-friendly, and the ERP system suits all businesses. Thus, Customer order placement has changed with technological development warehouses have to cater to satisfy customers with their best performance to hold their positions in the market. When moved to the cloud, the warehouse can cater to the customer with visibility, scalability, and market reactivity (Oracle). This will further reduce the costs of errors, and no upgrades will be needed where it will also be an additional cost (Angamma, J. S. K., & Jayawardena, A. M. A. 2022).

Therefore, companies and organizations, especially those specialized in the field of supply chain management and international logistics have to deeply think of transforming the traditional warehouse management approaches and systems to the digitalized warehouse systems. In fact, it's the factor which is crucial to reshape traditional operations and activities through the integration of advanced technologies. These digitalization techniques in warehouse management help companies and firms to adopt new market themes such as the flexibility and speed of responsiveness to market demands. So, it's a must for companies and firms to implement AI tools and applications in order to keep operational agility.

In other words, implementing real time data reporting, predictive maintenance, AI tools and applications contribute much more in optimizing space, storage and logistics distribution activities. *"The digital transition of warehouses, which takes into account sustainable development issues has very positive impact on warehouse performance"* (Kihel, Y. E. 2022). Again, the results and benefits from applying AI tools and applications in the day-to-day warehouse activities and operations count more and more of gains for companies and organizations. This fact is indicated by a Portugal research group who stresses the necessity of aligning warehouse operations with digital advancements to enhance customer satisfaction and streamline logistics processes.

Therefore, all these ingredients assure the fact that computerized tools, AI techniques and technological highly developed applications have a significant role and contribution in reshaping and revolutionizing inventory

management activities and operations within warehouses, leading to utilization of inventory levels.

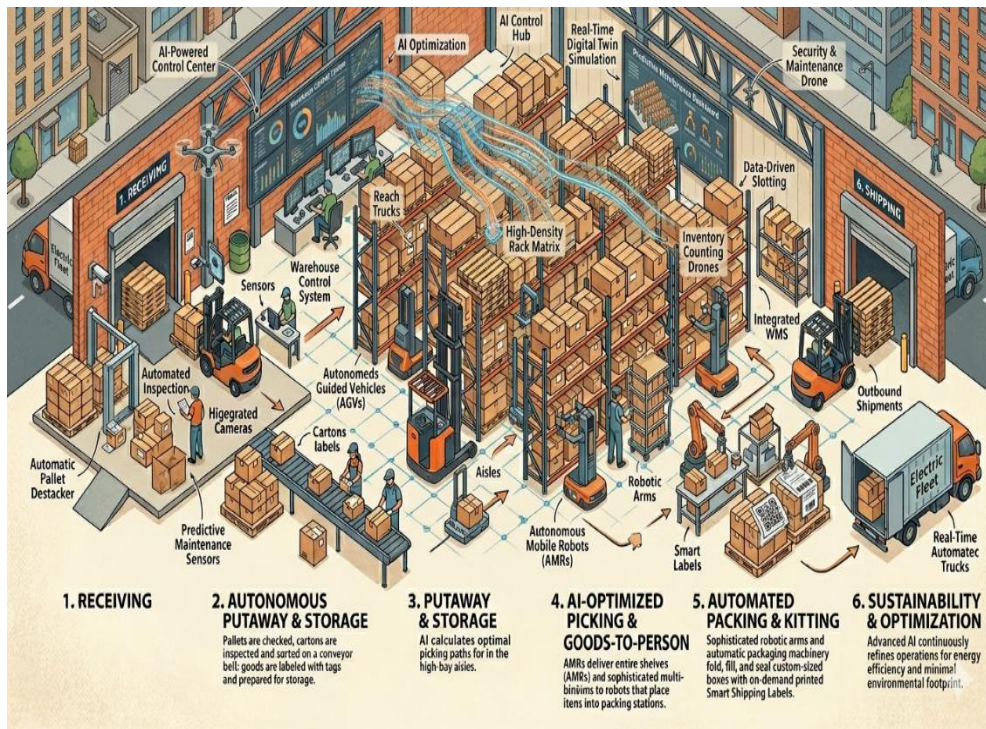


Figure 3 (Created by Researcher: Showing the normal process of AI-Driven Warehouse Management)

One of the most aspects, in which AI tools and applications play a major role in optimizing its share in the warehouse management, is demand forecasting. For more explanation, through analyzing historical data, inventory stocks and figures, weather conditions, geopolitical circumstances, AI algorithms can accurately predict future demand for products. These forecasts enable warehouses to adjust inventory levels proactively, minimize stockouts, and optimize replenishment cycles, leading to improved customer satisfaction and reduced carrying costs (Sodiya, Enoch Oluwademilade & et. al. 2024).

3- Efficiency of Using AI in Warehouse Management Systems

Many studies and researches have indicated that using AI in warehouse systems reflects actual measurable benefits on both managerial and operational levels. These studies revealed that AI systems achieved average cycle time reductions ranging from 15% to 45% compared to traditional warehouse

management systems. Simultaneously, automated tools and applications have reduced picking times by an average of 22%, accelerating order fulfilment and responsiveness flexibility for customer order management. For the space utilization aspect, AI-driven slotting systems achieved a 20%–35% improvement in space utilization. Also, some facilities reported as much as a 25% reduction in unused aisle space due to AI-digitalized systems; reporting average order accuracy rates above 98%.

Those studies reported that error rates in inventory counts reduced by over 40% following the adoption of machine learning approaches. In addition to that, in e-commerce environments, AI-based routing and slotting systems reduced average picking time by 40% and increased on-time delivery rates by 15% (Moin Uddin Mojumder1; Md. Nuruzzaman2. 2025).



Figure 4 (Created by Researcher: Showing the efficiency in figures of implementing AI in warehouse management systems)

4- Challenges & Future Perspective for AI in WH Management Systems

Data Consistency can be considered as one of the most significant aspects that represent a great challenge in implementing AI systems in warehouse management. This is due to the fact that if the data is inaccurate or outdated, the system will make wrong decisions resulting in stockouts, overstocking and delayed order movements. Therefore, WMS must be connected with the existing enterprise systems like Enterprise Resource Planning (ERP) or Transportation Management Systems (TMS) in order to

assure data consistency and accuracy. At the same time, change-resistance is another factor that represent a challenge to the management in implementing AI tools and applications in the warehouse management systems. This is due to the fact that employee who are used to work through traditional warehouse techniques may face difficulties in readapt themselves for using the new implemented AI software techniques. Also, high cost and new AI software high prices represent another majour challenge for firms and companies; especially those running small and individual kind of businesses (Faiz Mohiuddin Mulla. (2022).

Conclusion

Thus, from the previous mentioned discussion, it's obvious that digitalization and automation is the key pillar for operational excellence in the field of supply chain in general and in the field of warehouse management in specific. Therefore, companies and organizations, especially those who work in the field of supply chain, logistics and warehouses have to frequently apply and adopt AI in their operations to achieve remarkable gains and benefits on both the operational and financial levels.

On the other hand, companies board of director and general managers have to plan out policies and procedures to overcome the expected challenges and fears. For instance, on the level of data security, companies have to adopt high tech levels of securities for their data base, servers, clouds and info data bases in order to avoid cyber security attacks that may threaten their data servers. For employee resistance, it's recommended for companies to adopt well organized training courses for the staff who is being in continuous interaction with the AI tools and applications.

On the financial level challenges; it's recommended for organizations to seek financial support from funding authorities that are interested in the technological development sectors and AI techniques.

Abbreviations:

- AI: Artificial Intelligence
- ERP: - Enterprise Resource Planning
- TMS: - Transportation Management Systems
- WMS: -Warehouse Management System
- WH: - Warehouse

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