ỨNG DỤNG AI TRONG QUẢN LÝ KHO HÀNG CỦA SÀN THƯƠNG MẠI ĐIỆN TỬ: NGHIÊN CỨU TRƯỜNG HỢP CỦA ALIBABA VÀ ĐỀ XUẤT CHO DOANH NGHIỆP VIỆT NAM

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Tóm tắt

AI càng ngày càng được sử dụng nhiều trong quản lý chuỗi cung ứng, tuy nhiên việc ứng dụng AI trong quản lý kho lại ít hơn hẳn so với trong các mảng khác của chuỗi như thu mua, vận tải. Là một trong những sàn thương mại điện tử lớn nhất thế giới, để đáp ứng nhu cầu mua sắm online ngày càng tăng cao, Alibaba đã vận dụng AI để tự động vận hành và quản lý kho. Ở nghiên cứu này, nhóm tác giả hướng đến tìm hiểu cách Alibaba ứng dụng AI trong kho hàng, học hỏi từ đó để đề xuất một số kiến nghị cho việc ứng dụng AI tại kho của các sàn thương mại điện tử Việt Nam. Bằng phương pháp nghiên cứu định tính, nhóm tác giả đã sử dụng dữ liệu thứ cấp về kết quả kinh doanh của Alibaba từ năm 2018 đến năm 2022, dữ liệu về các công nghệ AI được Alibaba sử dụng trong quản lý và vận hành kho hàng, dữ liệu về sự ứng dụng AI của các doanh nghiệp Việt Nam trong lĩnh vực đó. Kết quả cho thấy AI đã giúp Alibaba tự động hóa các quy trình trong kho, phối hợp và trợ giúp với con người, tăng khả năng dự đoán nhu cầu cùng nhiều lợi ích khác. Từ đó các bên liên quan là các doanh nghiệp thương mại điện tử và Chính phủ có thể có những thay đổi phù hợp để giải quyết những khó khăn khi áp dụng AI vào quản lý kho tại các sàn thương mại điện tử ở Việt Nam.

Từ khóa: AI, Alibaba, thương mại điện tử, quản lý kho hàng.

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AI APPLICATIONS IN E-COMMERCE PLATFORMS' WAREHOUSE MANAGEMENT: ALIBABA CASE STUDY AND IMPLICATIONS FOR VIETNAMESE BUSINESSES

Abstract

Although AI is increasingly being utilized in supply chain management, warehouse management still uses it far less frequently than other parts of the chain, such purchasing and transportation. As one of the biggest online marketplaces, Alibaba has developed and implemented AI to autonomously run and manage the warehouse in order to fulfill the rising demand for online shopping. The authors of this paper seek to understand how Alibaba uses AI in warehouse operations and management in order to draw lessons from it and make suggestions to Vietnamese e-commerce platforms. The authors conducted qualitative study using secondary data on Alibaba's business performance from 2018 to 2022, data on Alibaba's use of AI in warehouse management and operation, and data on Vietnamese businesses' use of AI in that area. The findings demonstrate how Alibaba has benefited from AI by automating warehouse processes, coordinating and helping with people, improving demand forecasts, and offering many other advantages. Stakeholders in warehouse management, such as the government or business owners, could take note of that and use adaptation to overcome the difficulties.

Keywords: AI, Alibaba, e-commerce, warehouse management.

1. Introduction

Never before have people in the world witnessed such rapid changes in the economy as today, culminating in the outbreak of the Covid-19 epidemic. Online shopping is gradually being accepted and favored by many people, along with the increasing requirements for service quality that online sales businesses face. Customers are beginning to make more online purchases and anticipate receiving their goods or services more quickly and at a lower cost. Supply chains and logistics in today's fast-paced world must change quickly to meet the expectations of consumers. Therefore, they need to utilize technologies, one of which is AI.

Alibaba, one of the top 5 e-commerce platforms in the world at the moment, is always evolving and improving in order to survive. The optimization of warehouse management to decrease costs and speed up delivery is one of the solutions provided by Alibaba. In order to learn about the AI techniques in warehouse management of Alibaba, analyze them, and provide some recommendations for Vietnamese enterprises in the future, the authors have chosen the topic "AI Applications in Alibaba's warehouse management"

Several issues will be addressed in the report's content: *(1) How does AI help Alibaba operate and manage its warehouse system? (2) What are the advantages taken when applying AI in warehouse management?* And *(3) What recommendations could be made for applying AI in Vietnamese e-commerce platforms' warehouses from those observations?*

2. Theoretical framework

2.1. Warehouse definition

Warehousing is a very strategic supply chain service in that it allows firms to store their purchases, work-in-process and finished goods, as well as perform breakbulk and assembly activities, while allowing for faster and more frequent deliveries of finished products to

customers, resulting in better customer service when the system is designed and managed correctly (Wisner *et al.,* 2014).

Warehouses are used to support purchasing, manufacturing, and distribution. Firms place orders for raw materials, parts, and assemblies, which are typically shipped to a warehouse near or within the buyer's location and then transferred to the buyer's various operations as needed. In a retail setting, the warehouse may be regionally located, with the retailer receiving bulk orders from many suppliers, breaking these down and reassembling outgoing orders for delivery to each retail location, and then moving orders to the retail locations using a private fleet of trucks or for-hire transportation providers. When manufacturers deliver bulk shipments to regional market areas, similar distribution centers are used to break these down and ship LTL order quantities to customers (Wisner *et al.,* 2014).

2.2. Warehouse management

Warehouse management is "a combination of the planning and control systems and the decision rules used for inbound, storage, and outbound flows" (Faber, *et al.,* 2013, p. 1232), to support "process-oriented businesses centered on managing the flow of material and abstract resources, between a point of origin and point of destination" (Mahroof, 2019, p. 177). Warehouse management is inherently an information-intensive process because it focuses on coordinating activities related to goods and orders and a human-centered process that necessitates the use of a skilled human workforce.

2.3. Artificial Intelligence in E-commerce Warehouse Management

On the other hand, human intelligence appears to be limited in performing certain ecommerce tasks. This is particularly relevant to demand forecasting and supply chain mechanisms. Artificial intelligence appears to be a useful tool in these cases, which pose a challenge for businesses.

The goal of artificial intelligence is to "understand the phenomenon of human intelligence and to design computer systems that can mimic human behavioral patterns and create knowledge relevant to problem-solving" (Min, 2010, p.14). AI has the potential to overcome human intellectual and physical limitations (Daugherty & Wilson, 2018) enabling a wide range of application possibilities with significant implications for productivity and performance (Dwivedi, *et al.,* 2019).

AI is expected to improve internal business operations, make better decisions, improve existing products, free up workers for more creative work, create new products, and pursue new markets. In general, AI creates business value in three ways: process automation, innovative insights, and engaging stakeholders in business processes. Although AI has enormous potential, there are numerous challenges to its practical application. Many companies, it has been argued, have failed to achieve the expected productivity because managers do not understand how to effectively integrate AI with existing processes and systems.

AI applications are widely anticipated to improve warehouse management, including e-commerce fulfillment centers. Traditional warehouse layouts are considered less productive because the picker moves from one shelf to another and returns to the product collection point for each order. Even this traditional warehouse layout is unsuitable for warehouses that handle e-commerce sales. Because of the increasing volume of e-commerce sales, a new generation of warehouses specifically tailored to the needs of e-commerce companies to handle end customer

requests directly is required. Several AI warehousing applications have been proposed (Mahroof, 2019). For example, AI can be used to understand and predict sales trends in order to plan storage and replenishment (Mahroof, 2019; Min, 2010). According to Juniper Research (2018), demand forecasting based on AI will more than triple by 2023. AI has the potential to transform a variety of manual tasks and processes where human workers are limited by their physical capacity (Dwivedi, *et al.,* 2019). Thus, integrating AI with human employees in work processes is regarded as an effective solution for overcoming labor force and workload constraints (Miller, 2018; Risse, 2019).

3. Analysis of AI Applications in Alibaba's warehouse management activities

3.1. Overview of Alibaba

3.1.1. General information of Alibaba Corporation

Alibaba Group was founded in 1999 by Jack Ma and 17 associates. The *alibaba.com* website is a business portal that aims to connect manufacturers in China with international buyers.

Alibaba now ranks 6th on the list of the world's most valuable companies, with nearly 500 billion US dollars (September 2018 data from Forbes), ahead of the great Warren Buffett's Berkshire Hathaway. In the past 2017, since its inception (1999), this e-commerce empire has served nearly 2 billion customers and supported business for 10 million businesses. Across the Atlantic, Amazon - the world-famous ecommerce platform helped Jeff Bezos rise to the position of the richest man in the world, while Alibaba also brought Jack Ma many times to touch the title of Asia's No. 1 billionaire.

3.1.2. Vision – Mission

Alibaba's mission and vision is to make it easy for any business to do trade by providing a platform that fosters an open and fair marketplace where businesses from all over the world can come together and connect.

3.1.3. Business model and business performances

Firstly, about the business model

Alibaba's business model is heavily focused on B2B, where suppliers sell products in bulk to small or medium-sized businesses around the world, which businesses then resell to make a profit in the market. inland. In addition, a similar site to Alibaba.com is 1688.com, which was established in 2003 with the purpose of serving B2B between Chinese businesses.

Besides focusing on the B2B model, Alibaba also supports other commercial activities through the e-commerce Web system. Typically, Taobao is for consumers to transact, while Tmall is for the middle class in China to buy branded products. Furthermore, Alibaba has 6 more subsidiaries, including Aliexpress, 1688, Alimama, Alibaba Cloud, Ant Financial and Cainiao Network. All companies are doing well, generating multiple revenue streams and helping Alibaba group become a big ecosystem.

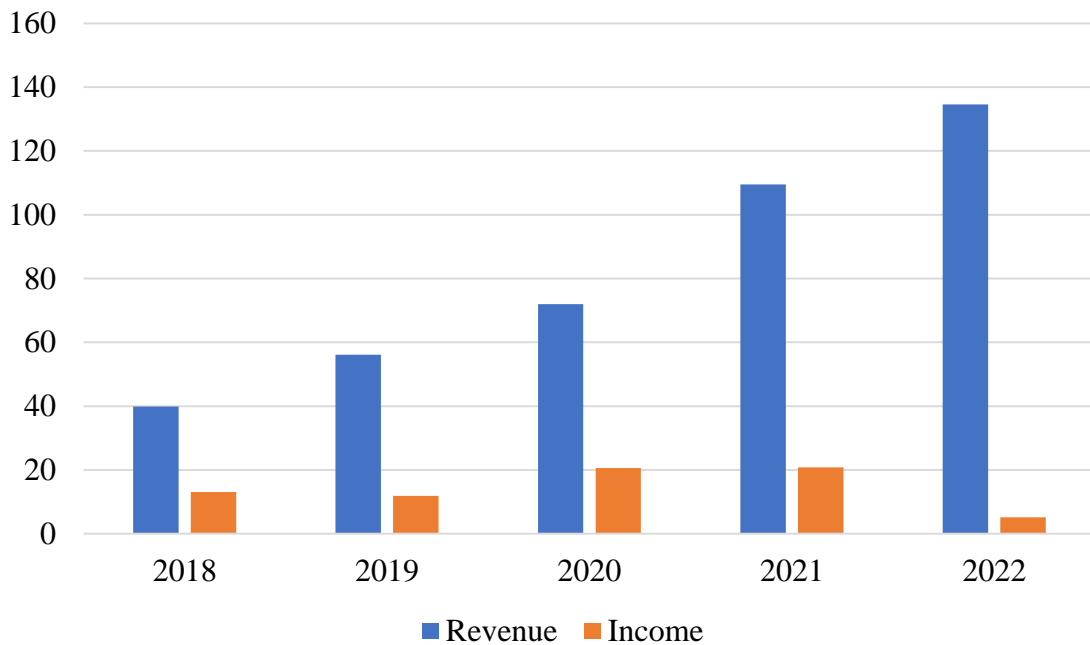**Secondly, about business performances**

Figure I. Alibaba's business performance in the period of 2018 - 2022 (Million USD)

Source: MacroTrends (2023)

Regarding figure I, in the period from 2018 to 2022, Alibaba has made significant strides in growth. In 2018, based on the annual financial report, Chinese ecommerce platform achieved a revenue of 39.8 million USD while the income after tax in this year equaled one third of revenue.

Entering 2019, the revenue of this business has increased significantly to 56.1 million USD. Still in the same year, Alibaba's income after tax had decreased compared to 2018. For 2020, Alibaba's revenue continued to increase to 71.9 million USD while the income also increased to 20.6 million USD.

In the next two years, revenue has a remarkable growth with nearly 110 million USD in 2021 and 135 million USD in 2022. Yet Alibaba's income after tax in 2021 did not increase much compared with 2020. The income of Alibaba even fell significantly by a quarter to over 5 million USD.

Overall, Alibaba in the period from 2018 - 2022 had a rapid growth rate with constant revenue and income. This is the result of smart strategies from the company and the support from the Covid 19 condition causing social distancing, especially from 2019 to 2021. However, due to some problems related to the Chinese government, Alibaba had suffered a bad business performance in 2022.

3.2. AI application in warehouse management of Alibaba

The e-commerce fulfillment center was built in 2014 to help Alibaba capture the market of millions of online shoppers in the Beijing-Tianjin-Hebei megalopolis. As people began to shop online for common things, a desire for dependable next-day or even same-day home delivery grew, becoming a significant differentiator that distinguished rival e-commerce platforms. This development trend, along with a volatile market, increased the complexity of demand forecasting, inventory planning, and warehousing. Workers' workloads grew as well, adding to

the difficulty and cost of human resource management. To solve these issues, Alibaba chose to investigate AI applications by collaborating with ALOG, a logistics service provider with superior technological knowledge, and MEGVII, an AI solution developer recognized for its image recognition technology. Throughout a four-year transition, the fulfillment center actively used AI technologies to increase the efficiency and efficacy of critical business operations. Artificial intelligence applications were applied in the commercial operations of product storage, order picking, and order packing. Considering the scope of our investigation, our study focused on the three mentioned operations and ignored those that did not use AI, such as products receiving, outbound shipping, and inventory auditing.

3.2.1. Goods storing

The Automatization Tridimensional Storehouse (ATS) is the primary AI application for storing inventory from supermarket vendors (Zhang *et al.,* 2021). Unlike typical structures, which feature wide aisles for manual handling of products by humans and forklifts, the ATS makes better use of both ground and vertical space, automatically accesses commodities without human involvement, and arranges things sensibly to enhance access efficiency.

In particular, commodities received at the fulfillment warehouse are loaded onto a pallet and transported to the ATS by a conveyer belt. The overall weight, three-dimensional size, and identity of the pallet are quickly detected and updated as stock-in data in the Warehouse Management System (WMS) using weight sensors, visual recognition sensors, and barcode scanners mounted at the conveyer's entry. Based on past data, the most efficient spot to store the pallet is then computed, and the pallet is forwarded appropriately.

WMS can detect the requirement for replenishment and offer instructions to the Warehouse Control System (WCS) by forecasting the demand for items. WMS and WCS collaborate to direct ATS in product storage and replenishment, ensuring a seamless order-picking process.

3.2.2. Order picking

The most important AI applications in order picking are some types of Automated Guided Vehicles (AGVs), namely: "Order to Man" (O2M) AGVs, "Goods to Man" (G2M) AGVs, and Forklift AGVs (Zhang *et al.*, 2021).

As soon as an order is received, WMS determines the suitable packing box based on stock-in data (e.g., 3D dimensions) and the packing algorithm. Selecting the correct box can help to reduce costs while protecting the environment. A worker then physically picks the box, applies a barcode, and sets it on the shelf rack supported by an O2M AGV. (MEGVII, 2021) An O2M AGV resembles a giant robotic vacuum cleaner with Wi-Fi and self-charging capabilities. It can transport things weighing up to 500 kilograms at a speed of 1.5 meters per second. Each shelf rack may hold up to 12 order boxes at the same time. When the robot has finished choosing orders for all of them, they are transferred to the packing zone. O2M AGV operates in the first zone, where order boxes approach employees who were instructed by their personal digital assistant, pick up things from specified shelves grouped adjacently. The commodities are placed in such a way that those commonly purchased together are kept near together. This significantly minimizes the distances that human labor must travel.

The order boxes are then transferred to the second zone, where G2M AGVs are employed. Items in this zone are stored in boxes that are carried to employees at set workstations for picking. (MEGVII, 2021) This sort of robot appears to be comparable to O2M robots. A

fundamental distinction is that an O2M robot handles a fixed set of order boxes, whereas a G2M robot handles many boxes at the same time. When an O2M robot needs an item in the second zone, a G2M robot will collect the storage box containing the item and deliver it to a worker, who will then choose the item and deposit it in the order box.

The third zone comprises bigger objects that are handled by forklift AGVs. These robots, like G2M AGVs, carry essential commodities to workstations where they may be picked up and placed into corresponding order boxes by human workers.

All robots in the order-picking process employ real-time data acquired by laser sensors. WCS analyzes this data using a robotic motion control algorithm to avoid physical impediments and coordinate various robots to prevent collisions and congestion.

3.2.3. Order packing

The order boxes containing selected products are examined and packaged during this step (Zhang *et al.,* 2021). Human employees would scan the barcodes on each order package and all products inside for automatic comparison and verification by WMS. When a discrepancy is identified, the technology alerts the human worker so that any errors may be fixed manually.

After checking that the selected order is valid, the human worker would pack the order box according to the instructions of a 3D packaging algorithm. This helps to ensure that things are properly packaged and that box space is used efficiently. For example, the algorithm ensures that potentially leaky objects are placed at the bottom, while delicate ones are placed on top. The packed boxes are then placed on a conveyor belt for outbound delivery. Table I summarizes the AI applications in the processes of goods storing, order picking, and order packing.

Table I. AI Applications in Alibaba's E-commerce Fulfillment Center

Process	Goods storing	Order picking	Order packing
Description	Collect stock-in data, optimize storage locations	Retrieve ordered goods from storage accurately and rapidly	Check goods picked for each order and pack safely
Data	Historical sales, real-time stock-in data, real-time order data	Historical sales, real-time order data, stock-in data, real-time operation	Order data, stock-in data
Algorithms	Sales forecasting, location recommendation	Sales forecasting, location recommendation, 3D packing, order wave combination, route planning, robot scheduling, robotic motion control	3D packing
Systems	WMS, WCS	WMS, WCS	WMS

Process	Goods storing	Order picking	Order packing
Robots/ Facilities/ Equipment	ATS, sensors and scanners	- "Order to Man" AGV - "Goods to Man" AGV - Forklift AGV	Scanners

Source: Zhang et al., 2021

3.3. Evaluation for AI application in warehouse management of Alibaba

It is evident from Alibaba's use of AI in warehouse management that humans and AI work best together to complete tasks that require both cognitive and physical effort. They cooperate to complement and improve one another's abilities in the fulfillment center:

3.3.1. Goods storing

AI helps automate the process of storing goods (De Koster *et al.*, 2007). The traditional warehouse is replaced with the AI-supported ATS during the process of storing goods in order to manage the growth of SKU count. *The arrangement of the received goods and the handling of items and withdrawal for order picking were solely the responsibility of human workers, so the process was labor-intensive.*

AI applications, such as real-time perception, analysis, forecasting, and planning, improve the original organizing ability of human workers in the fulfillment center. In addition, workers are kept out of the storage zone out of concern for their safety. In the ATS, machines completely replace workers in the handling of goods under the control of AI.

3.3.2. Order picking

AI improves selection when it comes to fulfilling orders (De Koster *et al.*, 2007; Wascher, 2004). The order picking process in the fulfillment center is facilitated by AI systems and over 500 robots. *Before AI systems, to locate the items and place them in boxes, workers had to pull moveable shelves with order boxes on them. To complete every order on the shelves, they circled back and forth in the order-picking area, repeating this process throughout their shift.*

Some restrictions still apply to robots. It is far more difficult and expensive for them to accomplish the precise operations of selecting and picking items of commodities. These duties might, however, be easily completed by human workers. Robots can transport the goods to the employees, who can then verify the accuracy of the items before adding them to the order boxes.

3.3.3. Order packing

AI improves the packing process during order fulfillment. The picked orders are inspected and packed as part of the order-packing process.

First, in order to direct workers' abilities to verify and assure the accuracy of the orders, AI's analyzing capability compares data on the orders and picked goods. Second, if errors are discovered throughout the checking process, operators from the fulfillment center will investigate the error links and resolve the problems. As a result, humans' capacity for problem-solving helps AI's capacity for learning to adapt the process including algorithms, data, etc.

3.3.4. AI improves the ability of worker and AI to interact together

AI capabilities interact with human capabilities in various ways and under various circumstances (Faber *et al.*, 2013; Mahroof, 2019). For instance, during the storage process, the warehouse's limited capacity for human handling and arrangement actually limits space utilization and raises the danger of human damage. In order to make the best use of space and maintain workplace safety, AI capabilities both augment and replace humans' handling capabilities.

As a result, AI in this process mostly serves to replace human workers. For example, the heavy workload of human workers throughout the picking process, human picking and selecting abilities work in tandem with AI moving abilities to reduce the workload as they improve the efficiency. AI capabilities maximize humans' organizing abilities and the ability to manage and operate the fulfillment center.

The most important activity in the packing process is order verifying, which requires not only inspecting the picked orders but also finding any weak points in the process. The development of the AI is helped by human problem-solving skills, which in turn guide human checking and packaging abilities. Hence, AI acts as a worker's assistant, helping them to study data and solve problems.

Overall, using automation efficiently helps organizations minimize logistics costs, assure stability and accuracy, shorten operating hours, enhance operational quality, prevent errors that may be brought on by human factors, and assist in raising competitiveness. This also helps to offer a cutting-edge working environment, which maximizes staff performance.

The three keys that contribute to the development of AI capabilities are robots, data, and AI algorithms (Faber *et al.,* 2013). In addition to standard warehouse resources, data from numerous sources was essential for planning, decision-making, and evaluating and forecasting.

From the application, and the benefits brought from applying AI in Alibaba's warehouse, we could draw some implications for Vietnamese E-commerce platforms to apply this model in the next section.

4. Recommendations for AI applications in warehouse management of Vietnamese e-commerce platforms

4.1. Challenges of Vietnam's e-commerce platforms in applying AI in warehouse operation

From the analysis in which Alibaba has integrated AI into its warehouse management operations as well as the assessment of the benefits achieved in applying AI, it is clear that the benefits that AI brings in their warehouse management, including the efficiency it brings as well as the cost and time savings of all 3 parties, such as supplier, customer and e-commerce platform. Nevertheless, there are still challenges that prevent the development of AI applications in warehouse management of each e-commerce platform, including issues with data and AI algorithms. The authors have researched and listed out several difficulties of applying AI in Vietnamese e-commerce platforms operations:

– ***Lack of data***: The first difficulty in applying AI to the warehouse management system in Vietnam is that the market size and warehouses of e-commerce platforms in Vietnam are not large enough compared to a large market like China, resulting in customer data not sufficient enough for AI to be trained and tested for effectiveness. Therefore, AI's forecasting function of the goods storing stage cannot work as efficiently as in Alibaba.

– ***Integration with current system***: Vietnamese e-commerce platforms also faces issues with AI-integrated systems since they are currently using different complex WMSs, such as Lazada with Salework software or Shopee with the system provided by Vietful. It will be difficult to integrate AI into those current systems because as opposed to Alibaba, which is able to do so because of the huge financial potential of AI. E-commerce platforms in Vietnam must compete with each other, and cannot take risks by using AI, which takes time to be effective. In addition, AI decisions can increase the complexity of the system leading to errors in warehouse management, which can lead to wrong decisions affecting the competitive advantage of each e-commerce platform.

– ***Cost-benefit conflict***: In addition, the e-commerces platforms in Vietnam have to think carefully before applying AI in warehouse management as the benefits AI brings in the beginning cannot offset the costs it causes, especially when e-commerce platforms in Vietnam are all recording losses. According to Hoang (2022), Lazada is holding the largest accumulated loss by the end of fiscal year 2021, reaching 373.4 million USD, exceeding the equity value of 7,600 billion VND while their rival Shopee has accumulated losses as of December 31, 2021 are about 320 million USD. However, the same model of e-commerce platforms in Vietnam in the past few years has begun to shift the trend from investment despite boosting revenue with Shopee this year (Hoang, 2022). 2019 was the worst-hit e-commerce platform with a loss of up to 102.4 million USD. Still, in the following years, the loss is gradually narrowed to USD 68.3 million (in 2020) and USD 33 million (in 2021). The fact that the trend is growing and cutting losses, plus the implementation of AI in warehouse management may require a large initial

investment to build the system and train the model, which will be very risky for enterprises since warehouse operations are one of the most important activities for any e-commerce platform, any mistake in this step can affect the competitive advantage of businesses.

– ***Human resource***: Moreover, the lack of high-quality human resources to operate the AI-integrated WMS could discourage Vietnamese e-commerce platforms to apply AI. Implementing AI in warehouse management requires training and capacity building for employees. Nhi Anh (2022) argues that only 30% of human resources at companies providing e-commerce solutions are now formally trained. Thus, up to 70% of e-commerce personnel in these units are recruited from other training specialties such as commerce, business, and information technology.

– ***Privacy***: Finally, in order to function effectively, AI needs to obtain user data, including supplier in order picking step, customer in order storing's supply and demand forecasting as well as carrier data when complete the order packing step, which can cause difficulties in promoting data sharing between parties. Since AI can gain access to sensitive information, which can be detrimental to users and create a bad buying experience, the security and protection of customers' personal information is an important challenge to address.

In summary, applying AI in warehouse management of Vietnamese e-commerce platforms can bring many benefits, but it also requires investment in both cost and time. However, once applying AI and in their warehouse management activities, Vietnamese e-commerce platforms can reap great benefits.

4.2. Recommendation for Vietnam's e-commerce platforms in applying AI in warehouse operations and management

From the above analysis, we can see that there are many difficulties in integrating AI into the warehouse management activities of e-commerce platforms in Vietnam. Nonetheless, with its potential, AI adoption will be a future trend for WMS, here are some suggestions for future AI integration development:

– ***Training high-quality staff:*** As Dang (2021) writes, in order to obtain high-quality human resources for the operation of the WMS with AI integration, both the e-commerce platform as well as the state need to take measures. First, the state needs to review, supplement, amend and promulgate new policies and legal documents in the direction of facilitating, encouraging and supporting e-commerce application activities including new business models based on digital technology. In addition, authorities also need to complete the system of legal documents on management of e-commerce business activities, supplementing regulations on management of cross-border e-commerce activities in order to create a healthy competitive environment in e-commerce, from which high-quality human resources can see the potential and be attracted. Next, on the side of e-commerce platforms, they need to strengthen cooperation and association between businesses and training institutions, from the consultation stage, to the orientation of the curriculum, the content of knowledge, the training capacity to the recruitment stage. Next, they need to create opportunities for staff to be specializing in e-commerce by participating in more training courses on related fields such as system administration, business administration, marketing, and commercial trade, international law... to effectively serve businesses. When those measures are taken, high-quality human resources

for the operation of the AI-integrated WMS will be greatly increased, creating favorable conditions for AI to be widely disseminated.

– *Improve the security of AI:* Data privacy and security are seen as a major barrier to AI projects (Ta *et al.,* 2021). To manage the risks of AI, e-commerce platforms should develop appropriate processes, make informed decisions, ask the right questions, and apply key standards. Plus, they need to think of AI as a living entity, not a most powerful technology as well as test employees' perceptions to make sure they will not reveal how AI being applied in the systemsystem Executives should demand a full analysis of how employees, customers, or users are adopting this system and responding to decisions from AI. Moreover, they then need to analyze decisions about AI products in the real market, where there are many different users, to see the quality of those decisions. In addition, it is necessary to compare the quality of the decisions of the algorithms in similar situations with that of not using them. Before deploying products on a large scale, it is important to carefully remove untested products. E-commerce platforms should consider testing them in a limited market to better understand their accuracy and behavior when various factors are involved, like when users are not equally skilled, data from different sources, or a changing environment, based on that, failure in setting signals the need to improve or remove AI algorithms. Finally, e-commerce platforms in Vietnam should develop plans to get certified to test AI products before they go to market. Companies may need to develop a similar framework of their own with continuous monitoring (products and services and environment) based on AI, when they may find that their technology is not as it was originally designed. In order for effective operation, each e-commerce platform must regularly monitor, measure, and test programs with preventive maintenance tools in production or in the field of cybersecurity.

– *Providing a big data source for AI:* According to Anh Quan (2022), to be able to let AI operate effectively, it needs a large enough and quality data source, through which AI can train its algorithm to make the most accurate decisions. From there, e-commerce platforms in Vietnam should come up with a common data warehouse, from which the AI can start its training. In addition, Lazada is planning to build a data center in Vietnam. Specifically, a data center is used to store user information and many large technology corporations can consider placing this infrastructure in Vietnam. This is considered a new move in meeting the security and database requirements set by the Vietnamese government for businesses operating across the country. It can be seen that building a data warehouse is becoming a new trend for e-commerce platforms today, which also greatly contributes to the application of AI to any system of e-commerce platforms, including WMS.

To conclude, the application of AI is definitely an inevitable trend of any e-commerce platform, AI will be a tool to improve key KPIs for business success. However, to be able to take full advantage of the benefits that AI brings, Vietnamese e-commerce platforms need to have a sufficient foundation for AI development, create digital facilities that allow data to be stored, integrate high-quality data in multiple systems, and build a team of data experts both from inside and outside the e-commerce platform.

5. Conclusion

After the analysis of AI Applications in Alibaba's warehouse management, it can be seen that not only AI helps automate the process of storing goods, improves selection in fulfilling orders and the packing process during order fulfillment, but AI also interacts with human

capabilities in various ways and under various circumstances. However, there are still several difficulties that Vietnamese e-commerce platforms need to overcome when applying AI, including lack of data, integration with current systems, cost-benefit conflict and so on.

Several implications are to be suggested to Vietnamese e-commerce platforms to solve the challenges and improve their warehouse management activities by AI. Vietnam e-commerce platforms should train high-quality human resources for the operation of the WMS with AI integration, provided that the help to encourage e-commerce activities from the Government has been taken place. In addition, businesses should provide a big data source for AI and improve the security of AI.

Lastly, a lot of challenges exist in comprehending and assessing the present state of AI since there has not yet been an official report on particular data on the situation of AI application in warehouse management and because the information source is still scarce. Over this, it will be necessary to offer additional improvements to the authors' proposals as they are not entirely persuasive. We sincerely value reader feedback and comments to advance the report.

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