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Applications of Artificial Intelligence (AI) In the Logistics Industry in Vietnam: Opportunities and Challenges

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Abstract:
Logistic industry has rapidly developed in Vietnam. The modern solutions in logistic industry help users to transport goods effectively. In recent years, the artificial intelligence (AI) has been widely applied in logistic industry to improve the performance of the field. Artificial intelligence (AI) technology plays an important role in logistics, bringing great potential and benefits to the industry. It improves operational efficiency, forecasts demand, manages risks, enhances customer experience and reduces costs. With the continuous development of AI technology, the logistics industry will continue to improve and enhance in the future. The paper presents and analyzes some AI applications using in logistic industry in Vietnam. Moreover, the paper analyzes the impacts of the AI applications for the field in Vietnam.

Keywords: Logistic industry, artificial intelligence, smart transportation

1. Introduction

Artificial Intelligence (AI) is a field of computer science that focuses on developing systems that can perform tasks that normally require human intelligence (Boute, 2023). AI not only helps machines learn and adapt from experience, but also makes complex decisions, predicts trends, and automates processes. Logistics is the process of managing the storage and transportation of goods from the point of origin to the point of consumption (Chen, 2024). It includes many activities such as supply chain management, warehouse management, transportation, and distribution.

Currently, AI is widely applied in the logistics field to optimize processes, increase operational efficiency, and improve customer experience. AI not only helps businesses predict demand for goods, but also optimizes transportation operations, warehouse management, and automates back-office tasks.

Vietnam currently has about 4,000 enterprises providing international and domestic logistics services; of which, about 1,300 enterprises are actively operating, however, the majority are small and medium-sized, only 1% are large enterprises. Vietnamese logistics service enterprises apply technology to business operations at a low level.

In the face of the digitalization trend, Vietnamese logistics enterprises will gradually adapt, promote research, and apply technology to operations to standardize operating processes, optimize costs and resources of enterprises; monitor, enhance management capabilities, evaluate service quality and increase customer loyalty. The development of the logistics market creates many opportunities for logistics service enterprises, but also poses many challenges, requiring enterprises to improve their competitiveness through the application of digital technology.

2. Literature Review

In the context of current digital transformation, there are many domestic and foreign studies on AI applications in the logistics industry. In the work of (Le Thanh Phuong, 2024), the author deeply analyzed the applications of artificial intelligence in the logistics industry in the world and in Vietnam. The paper pointed out existing limitations, causes and proposed measures to promote the application of artificial

intelligence in Vietnam's logistics industry. In 2017, The Economist published an article titled, "The world's most valuable resource is no longer oil, but data" (The Economist, 2017). The use of digital applications as well as the connectivity of assets through, e.g. sensors and digital control towers, generates large amounts of data (possibly in real-time). The question that now arises is how such data can be leveraged to improve the level of intelligence of logistics and supply chain decision-making. Notice that the use of data in logistics is not new—we have been transporting goods around the world based on data-driven forecasts for decades. What is new is the sheer volume of data that we now generate,
store, and share. These data have the potential to make logistics and supply chain control more adaptive and smarter.

In traditional data-driven applications, one typically uses one or—at most—a few sources of data, such as historical demands or current inventory levels. As long as the input variables remain 'countable,' one can implement (or even program) if-then instructions to support (or even automate) decision-making. The integration of various digital applications, in contrast, generates a data pool of different sources, collected automatically through sensors (Internet of Things) as well as manually through mobile and wearable communication devices (known as the Internet of
People). When the number of data sources grows rapidly, the ensuing mountain of data makes the explicit enumeration of if-then instructions infeasible.

This is where machine learning comes into the picture. Whereas AI is the umbrella term for all computer rules that mimic human intelligence (including if-then instructions), machine learning is the subset of AI where an algorithm learns to mimic human behavior and makes its own decisions. Machine learning algorithms are in essence prediction machines that perform a task without using explicit instructions (Agrawal et al., 2018).

3. AI applications in logistic industry in Vietnam

In the context of globalization and the boom of e-commerce, the logistics industry is facing increasing pressure in managing complex supply chains. Artificial intelligence in logistics has become a key solution, helping businesses automate processes, analyze big data and make more accurate decisions. According to forecasts, the AI market in logistics will grow strongly from 17.96 billion USD in 2024 to 707.75 billion USD in 2034, with a compound annual growth rate (CAGR) of 44.40%. This growth reflects the great potential of applying artificial intelligence in logistics, especially in optimizing costs and improving operational efficiency. As of 2023, Vietnam ranked 43/100 in the Logistics Performance Index, placing it in the top 5 ASEAN countries, after Singapore, Malaysia and Thailand, and on par with the Philippines. Vietnam's logistics market is expected to grow by 14-16% by 2025, contributing about 5% to the country's GDP by 2023. The market is expected to continue its strong growth momentum from 2023 to 2027, with an expected compound annual growth rate (CAGR) of 5.5%. Currently, most logistics companies in Vietnam have only deployed basic technologies into their operations or are in the early stages of applying digital technology; most are still unfamiliar with advanced technology solutions. This attitude reflects a reluctance to transform and adapt in a world where the technology era is increasingly widespread.

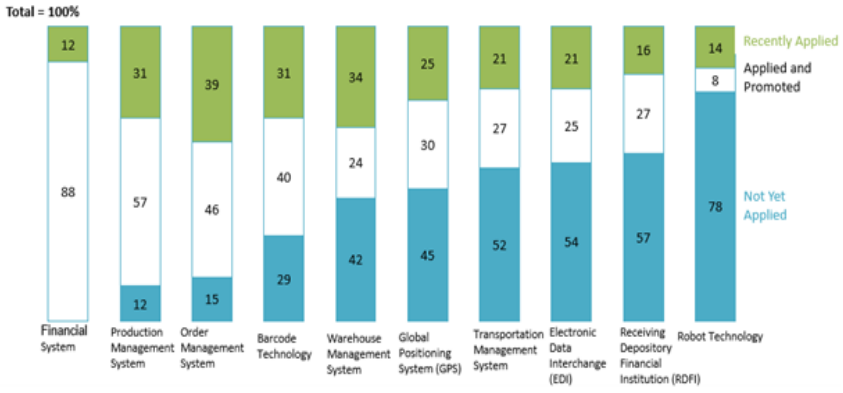

Figure 1. IT Applications in Logistics Companies in 2023

(Source: Vietnam logistics report 2023)

Another barrier to digital transformation is lack of capital. In Vietnam, more than 98% of businesses are small and medium-sized enterprises (SMEs), and 99% of these companies face capital constraints. In

addition, there is a lack of coherent policies and a legal framework specifically designed for logistics. A shortage of specialized logistics professionals, especially those with advanced skills in implementing new technologies, limits the ability to meet the changing needs of the industry.

According to the Vietnam Logistics 2023 report, up to 88.6% of logistics service enterprises believe that e-commerce will help promote digital transformation (Figure 2). This is the technology with the highest selection rate, demonstrating the important role of developing customer access channels and online sales of logistics service enterprises. In addition, important technologies such as big data analytics (50.9%) and artificial intelligence (50.6%), which play an important role in processing and analyzing data to make smart decisions and optimize logistics processes, ranked second and third, respectively. The Internet of Things (48.1%) is widely applied to track and manage transportation, warehousing and cargo sensors. This helps improve processes and safety. Cloud computing (44.6%) helps businesses store and share data effectively, providing flexibility and cost savings. Blockchain (38.4%) is used to improve transparency and security in supply chain management, helping to track the origin and history of goods.

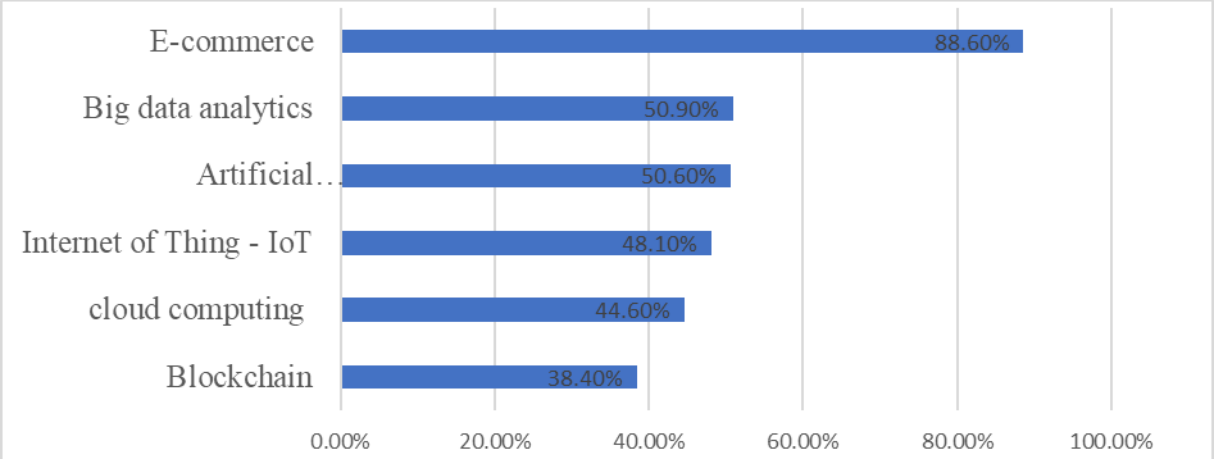

Figure 2. Technology applications in logistics in Vietnam

(Source: Vietnam logistics report 2023)

The application of artificial intelligence in logistics in Vietnam is still limited, some popular applications include:

Route4Me is a widely used route optimization platform globally. It helps growing businesses overcome the complexity of last-mile delivery to increase efficiency and provide services that customers can trust. Route4Me's route optimization platform optimizes and integrates critical last-mile workflows, including route planning, assignment, tracking, driver performance, delivery management, and customer experience. Route4Me's analytics enable continuous improvement with real-time visibility, actual vs. planned KPIs, and last-mile performance history.

Llamasoft is a supply chain planning company that uses artificial intelligence to help organizations make smarter supply chain decisions faster. They provide supply chain planning and design software that helps optimize decisions on supplier selection, inventory management, and supply chain optimization.

Sapo Order Fulfillment is an AI-based sales management software that integrates ordering and shipping management. It helps business owners optimize the process of managing in-store sales, shipping orders, and business situations easily. Despite the many benefits, the use of artificial intelligence (AI) in the logistics sector also faces some challenges. Here are some of the challenges:

Investment costs: Implementing AI in logistics requires large investments in hardware, software, and infrastructure. This can be a challenge for small and medium-sized businesses. However, with the development of technology, this cost can be reduced and become more popular.

Lack of experts: To deploy and manage AI systems in logistics, experts with knowledge of AI and logistics are required. Currently, the lack of human resources with expertise in this field is a challenge. The response can be to train and attract human resources with the necessary knowledge and skills or to cooperate with technology companies.

Security and risks: AI collects and processes large amounts of data related to goods, processes and customers. This raises issues of information security and confidentiality. To deal with this, security measures

such as data encryption and periodic system security checks need to be applied. The ability to prevent attacks and intrusions needs to be improved and enhanced.

Innovation and user acceptance: Sometimes, the application of new AI technology in logistics can face difficulties in changing user habits and acceptance. To address this, it is necessary to create educational campaigns and guidelines for users to help them understand and accept the use of new technology.

Legal and ethical: The use of AI in logistics raises legal and ethical issues such as privacy, fairness and responsibility. Appropriate policies, regulations and standards are needed to address these issues and ensure respect for the ethics and rights of stakeholders.

To address these challenges, cooperation between businesses, governments and relevant organizations is needed. At the same time, raising awareness and capacity of workers to use and operate AI systems in logistics is also an important factor.

Take Viettel Post as a typical example:

+ Viettel Post aims to create a closed ecosystem based on a smart Logistics platform to provide the best service to customers.

+ In 2018, Viettel Post launched the Viettel Post delivery application with many breakthrough technologies, marking the transformation of a business in the 4.0 technology revolution.

+ Viettel Post's total revenue over the years

Table 1. Total revenue over the years

Year	2016	2017	2018	2019	2020	2021	2022
Total Revenue (billion dong)	3643	4053	4313	7908	17342	21555	21743

Example 2, Transimex Joint Stock Company:

- Transimex Joint Stock Company is one of the leading logistics service providers in Vietnam. Transimex was established in 1976 and is headquartered in Ho Chi Minh City. The company currently has more than 620 employees and a wide network of operations throughout Vietnam. Transimex continues to invest and develop to become one of the leading logistics service providers in the region. Since 2020, Transimex has begun to apply AI technologies in its operations.

- The following table shows more clearly the development of Transimex through the production and business performance in 2020 compared to 2022:

Year	**2022**	**2023**
Revernue	2400 billion dong	3648 billion dong
Profit before tax	400 billion dong	774 billion dong
Services provided	Transportation, warehousing, customs clearance...	Transportation, warehousing, customs procedures, e-logistics, green logistics, logistics 4.0, …

Transimex's revenue and profit after tax in 2022 will increase significantly compared to 2020 (the year of application). The enterprise can also expand its network and services. Thereby, it can fully meet the needs of customers.

4. Challenges and opportunities

Application of AI in Logistics opens up potential development opportunities for businesses:

Enhance competitiveness: Application of AI in Logistics can help optimize operating processes, minimize errors, improve performance and improve customer experience. Thereby contributing to creating sustainable competitive advantages for businesses

Opening up many new business opportunities: AI not only improves existing processes but also creates new business opportunities. For example, developing delivery services by drone, self-driving cars.

In addition to the above opportunities, application of AI in Logistics also causes businesses to face the following challenges:

High initial investment costs: Application of AI in Logistics requires businesses to invest heavily in technology infrastructure, including hardware, software, and data systems. In addition, the cost of developing and integrating AI systems into existing processes is also quite high;

Lack of skilled human resources: AI is a highly specialized field and recruiting employees with knowledge and skills in AI is quite difficult. Moreover, applying AI in Logistics also requires businesses to retrain current staff;

Data security: AI takes on the task of processing a large amount of data related to customers, products, and freight transportation. Therefore, securing this data is a big challenge, especially in the context of increasing cyber attacks as it is today;

User acceptance: Applying AI in logistics is sometimes difficult because users still keep old habits or are reluctant to change to accept new AI technology

5. Conclusion

As such, artificial intelligence (AI) is transforming the logistics and transportation industry worldwide, streamlining operations and improving efficiency through automation, data analytics and predictive capabilities. As Vietnam strives to become a competitive logistics hub in Southeast Asia, the use of AI could be key to overcoming operational inefficiencies and positioning itself on the international stage. Artificial intelligence plays an important role in the logistics sector, helping to increase the efficiency and productivity of businesses. Based on the analysis of practices in Vietnam, the author proposes a number of measures to promote the application of AI in the logistics industry.

First, logistics enterprises need to develop a digital transformation strategy, digital transformation goals and a digital transformation roadmap for their own enterprises. The strategy needs to identify technology applications including artificial intelligence in all aspects of the enterprise's operations.

Second, enterprises need to clearly identify the factors that affect the process of applying technology to the enterprise. Depending on each enterprise, the main factors may be leadership will, human resources capacity, process system, capital or technology platform. Correctly identifying these factors is especially important for enterprises to be able to choose the most suitable direction for themselves.

Third, the choice of technology application model in the enterprise needs to be carefully researched. Enterprises should closely cooperate within the logistics industry, as well as seek advice from digital transformation service providers to help enterprises determine the appropriate direction.

Finally, businesses need to ensure that the process of transforming operations based on digital technology platforms must be carried out firmly, following a roadmap suitable to the specific capabilities of each business. Businesses should also clearly define the goal of software application, which should aim to increase customer experience, ensure accurate and real-time information retrieval; at the same time, the goal is to serve operations.

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