THE IMPACT OF ARTIFICIAL INTELLIGENCE IN LOGISTICS MANAGEMENT ON SUSTAINABILITY DEVELOPMENT OF E-BUSINESS

Sergii Lysenko [1], Oksana Makovoz[1,2*], Tetiana Perederii[3]

[1]National Technical University "Kharkiv Polytechnic Institute", Kharkiv, Ukraine;

[2]Researcher, Dresden Technical University Dresden, Germany

[3] State University of Trade and Economics, Kyiv, Ukraine;

*Corresponding author: oksana.makovoz@tu-dresden.de

***Abstract.** In the conditions of all-encompassing transformational changes in the economic system of Ukraine, the key to the success of the functioning of domestic trade enterprises in the long term is ensuring their sustainable development. At the same time, in recent years, domestic trade enterprises have been operating in the face of global challenges, such as the COVID-19 pandemic, and now they are facing the consequences of the ongoing large-scale armed aggression of the Russian Federation against Ukraine.*

In particular today, a significant number of trade enterprises faced problems relocation, deterioration of supply conditions and disruption of logistics chains, complication of product sales processes, outflow of highly qualified personnel for border, the need to transfer employees to remote work, loss property, lack of sufficient equity, which is directly negative affects their effectiveness and efficiency and complicates (makes it impossible) further development.

For many years, the logistics industry remains to be one of the most actively growing industries. However, there are some barriers that prevent many logistics companies from their expansion and growth, including the lack of access to real-time data that can demonstrate the most relevant road conditions, low control over delivery processes, low transparency of supply chain stages, and inaccurate route planning.

Nowadays, among the factors that prevent the industry from further development, we can name the lack of access to real-time data that can demonstrate the most relevant road conditions, low control over delivery processes, low transparency of supply chain stages, and inaccurate route planning.

Introduction. The object of research is the process of digitization of logistics services through the impact of AI in logistics management on sustainable development of e-business. Analysis of the current state of logistics services and trends of digital transformation in logistic processes.

Materials and Methods. The study used general scientific and special research methods, in particular, methods of critical and scientific analysis for analyzing AI trends in logistics management, abstract and logical methods for theoretical generalizations (systematization of directions for using AI in logistics) and formulation of conclusions. The research was based on statistical data, data from analytical publications, and expert opinions of market experts and companies in the industry. The research aim is to analyze the AI trends of logistics management and the impact AI on e-business in the world.

Results and Discussion. However, today it is not possible without sustainable logistics and transportation aim to improve profitability and reduce the ecological impacts of logistics activities.

99

Seeking a balance among economic growth, environmental care, and societal health, sustainable development in logistics has drawn tremendous attentions from different aspects.

Supply chain agility is set to become one of the focuses of logistics trends in 2023 as businesses strive to satisfy the ever-increasing demand for products and services. Agility will enable businesses to quickly and efficiently respond to fluctuations in supply and demand while also reducing costs and increasing efficiency and is therefore an essential part of staying competitive in today's ever-changing market [1].

E-business promotes sustainable development in the fields of economic prosperity, poverty reduction, social development, international cooperation, etc. It provides people with decent work and increases economic growth in short and long-run. It is now important to use more advanced technologies such as data management, data engineering, data science and machine learning to work with data that is profitable [2].

Since sustainable logistics is characterized by the use of artificial intelligence, we have analyzed modern trends in detail in Table 1.

Table 1.

Analyze the AI trends of logistics management

(constructed by the authors based on sources [1, 3 – 9])

Modern trends	Description of trends
The Internet of Things (IoT)	enables multiple resource-constrained embedded devices, objects, and humans to connect through the Internet protocol for a ubiquitous data exchange in real-time data. In addition, the valuable information extracted and transformed from the IoT data can be exploited to create intelligent services and applications to improve the logistics activities as well as the overall performance of logistics operations [3].
AI algorithms	combined with machine learning support companies to be proactive in dealing with demand fluctuations. For example, AI-based forecasting solutions allow managers to plan supply chain processes and find ways to reduce operating costs. Self-driving AI and smart road technologies are affecting a positive shift towards delivery service automation. In addition, AI-based cognitive automation technology brings intelligence to automate administrative tasks and speeds up information-intensive operations [1].
An automated storage and retrieval system (ASRS)	can deliver high efficiency but may be limited in flexibility when it comes to dealing with order disparities in size, shape, weight, volume and mechanical properties. The ASRS may not offer adequate scalability to adapt to growth and cope with increased seasonal demands, or deal with facility breakdowns and carry out technical maintenance. Robotics promises to strike a balance between efficiency, scalability and flexibility [4].
Last-mile delivery	is a defining service in logistics as it is directly related to customer satisfaction. However, last-mile delivery faces various problems including delays due to traffic congestion, customer nuances, government regulation, and delivery density [5].
Warehouse automation	increases efficiency, speed, and productivity by reducing human interventions. Warehouse automation technologies can be broadly categorized into devices that assist the movement of goods and those that improve their handling. In the first group, we've already seen automated guided vehicles (AGVs) that move cases and pallets. New twists are the equipment and software needed to

	retrofit standard forklifts and make them autonomous. The new gear can be switched on whenever needed—peak seasonal shifts, say—and the forklift can remain manual when demand is slower [6].
Blockchain	is an emergent technology concept that enables the decentralized and immutable storage of verified data. Over the last few years, it has increasingly attracted the attention of different industries. Especially in Fintech, Blockchain is hyped as the silver bullet that might overthrow today's payment handling. Slowly, the logistics and supply chain management community realizes how profoundly Blockchain could affect their industry[7].
Big data analytics	provide actionable insights for improving warehouse productivity, performance management, and utilization of logistical resources. The data obtained from monitoring position and weather along with fleet schedules help optimize routes and delivery planning. The analysis of market data supports the further optimization of supplier pricing, inventory levels, and the generation of risk management reports. Moreover, advanced analytics provide insights that help identify anomalies and offer predictive maintenance solutions [5].
Autonomous vehicles	improve vehicle safety and deliver goods safely by eliminating human errors while driving. They increase the efficiency in the first and last-mile delivery as they are designed to work all day and all night. Moreover, autonomous vehicles improve fuel efficiency by using platooning techniques for long-haul routes, reducing traffic jams, and optimizing travel routes by taking advantage of AI-enhanced technology [5].
Elastic logistics	refers to a company approach that is adaptable and flexible enough to scale up or down in response to market demands. This enables supply chain activities to expand or contract in near real-time in response to foreseen (and even unpredicted) market events. Picking and packing are automated in elastic logistics, forcing warehousing and logistics to make more supply-driven decisions. This never-ending supply-driven expansion and contraction of warehouse activities allows for more reliable financial control. Companies may run supply chains more efficiently in the face of volatility with elastic logistics, which allows for scalable upscaling and downscaling based on seasonal activity and other changes. The balance of supply and demand has swung heavily in favour of demand [8].
Digital voice assistants	is a software program that can perform simple tasks or services, and is generally controlled by voice command. According to a forecast, around 200 million of these smart speakers will be sold worldwide in 2023. The best-known language assistants are Amazon's Alexa, Google Assistant and Apple's Siri [9].

For a deeper investigation of the role of AI in the logistics process in our view, it is necessary to consider logistics management practices and examples of the use of AI in E-business.

At IBM, the researchers estimate that relatively moderate investments generate a much larger ROI than before. The complexity of AI is growing: more unstructured data, complicated algorithms, high-level tasks, etc. And the output of AI to amplify transportation services and global supply chains increases as well. Over the past years, AI in supply chain and logistics has proved to be effective [10].

Artificial intelligence gives machines and systems the capability to analyze their environment and make decisions with some degree of autonomy to achieve specific goals [11].

That is why the use of artificial intelligence focused on sustainable development is relevant in conditions of uncertainty. It can provide solutions to many challenges, such as treating diseases or minimizing the environmental impact of farming. Artificial intelligence (AI) is an area of strategic importance and a key driver of economic development.

As a result, logistics specialists lose a lot of time fulfilling monotonous repetitive paperwork tasks instead of devoting time to more creative and intellectual activities.

The global TMS (Transportation Management Systems) market is expected to grow at a CAGR of 14.5% and almost double over the next five years, from USD 2.5 billion in 2019 to USD 4.3 billion by 2025 [12]. The development arc of these systems mirrors the exponential growth in data sources, such as IoT sensors, actuators, RFID, GPS, and barcodes. As a result, modern transportation management systems need to do more than record time and place of shipments. Today, a digital TMS needs to facilitate smart functionalities like dynamic routing and automation across the transportation lifecycle to enable businesses to optimize transportation performance in real-time. Dealing with the volume and the diversity of this new data will be next to impossible without embedded ML and AI. An ML/AI-enabled intelligent TMS can automate almost every process across the transportation value chain, starting with load tendering. In fact, smart systems that combine advanced analytics and embedded intelligence are able to autonomously handle 25% [13] or more of load tendering and automate related activities, including booking, approval, routing, and alerts.

TMS applications can save money and help operators to increase service performance. They can do this by:

‒ helping resource planners to optimize routes for truckload and less-than-truckload shipments

‒ identifying when and where multi-stop routes prove more economical than single-stops

‒ highlighting the comparative performance of carriers

‒ analyzing data to answer questions such as "Which specific geographic areas are impacted most often by late deliveries?" [14]

Technologies like AI and ML are facilitating a new generation of transportation management solutions that continuously learn by comparing inputs with outcomes. They also introduce innovative capabilities such as real-time fleet tracking, improved vehicle utilization, and more cost-effective and proactive approaches to fleet maintenance. Most important of all, intelligent TMS allows companies to come up with the best transportation and logistics strategies that perfectly balance the competing priorities of shippers, drivers and fleets without compromising service levels [15].

According to McKinsey: «The future of supply chain: digital and AI will enable end-to-end transparency and faster decision making». Logistics and distribution will have the following impact: «Dynamic optimization of routing, freight contracting, and vessel sharing, reducing costs and environmental impact» [16].

AI, according to a Deloitte report [17], is helping to drive more value from rules-based automation. Among survey respondents, 78% use AI to drive more value from rules-based automation (or are planning to do so in the future). Among manufacturers, this figure jumps to 93%. For example, Walmart and Procter & Gamble have collaborated to create an automated re-ordering system. Walmart utilizes satellite communications, which are then sent to Procter & Gamble whenever an item is needed. Procter & Gamble then fulfills the order and delivers the item. This helps Walmart form more accurate forecasts and react more efficiently to customer needs.

Predicting product demand and planning logistics can improve service, decrease transportation costs, and save money. AI predicts the market, modifies orders and reroutes products in warehousing. These estimates help your enterprises alter orders and deliver in-demand commodities to local warehouses. AI can connect warehouses to discover the optimal inventory transfer solution [18].

The systematization of directions for the use of AI in logistics is shown in Figure 1.

AI can assist a company in more efficiently planning its hiring and training processes. It will be useful if you are a startup company looking to hire employees. Even established businesses can use it to hire suitable employees effectively. This enables efficient day-to-day operations on the organization's floors. Also, it results in better-suited work assignments, which makes employees happier. Thus, it becomes a win-win situation for both.

The presence of these AI trends in the development of logistics service use cases in the transport and logistics industry worldwide has 2020 «Global AI use cases transport and logistics industry 2020» [19], according to a study on the Statista website, with 40 percent of respondents stating that artificial intelligence can help improve inventory management. By implementing AI, businesses can create smarter production and distribution centers. Thus, AI can understand the complex dynamics of real-time inventory management, predict scenarios, recommend actions, and act accordingly.
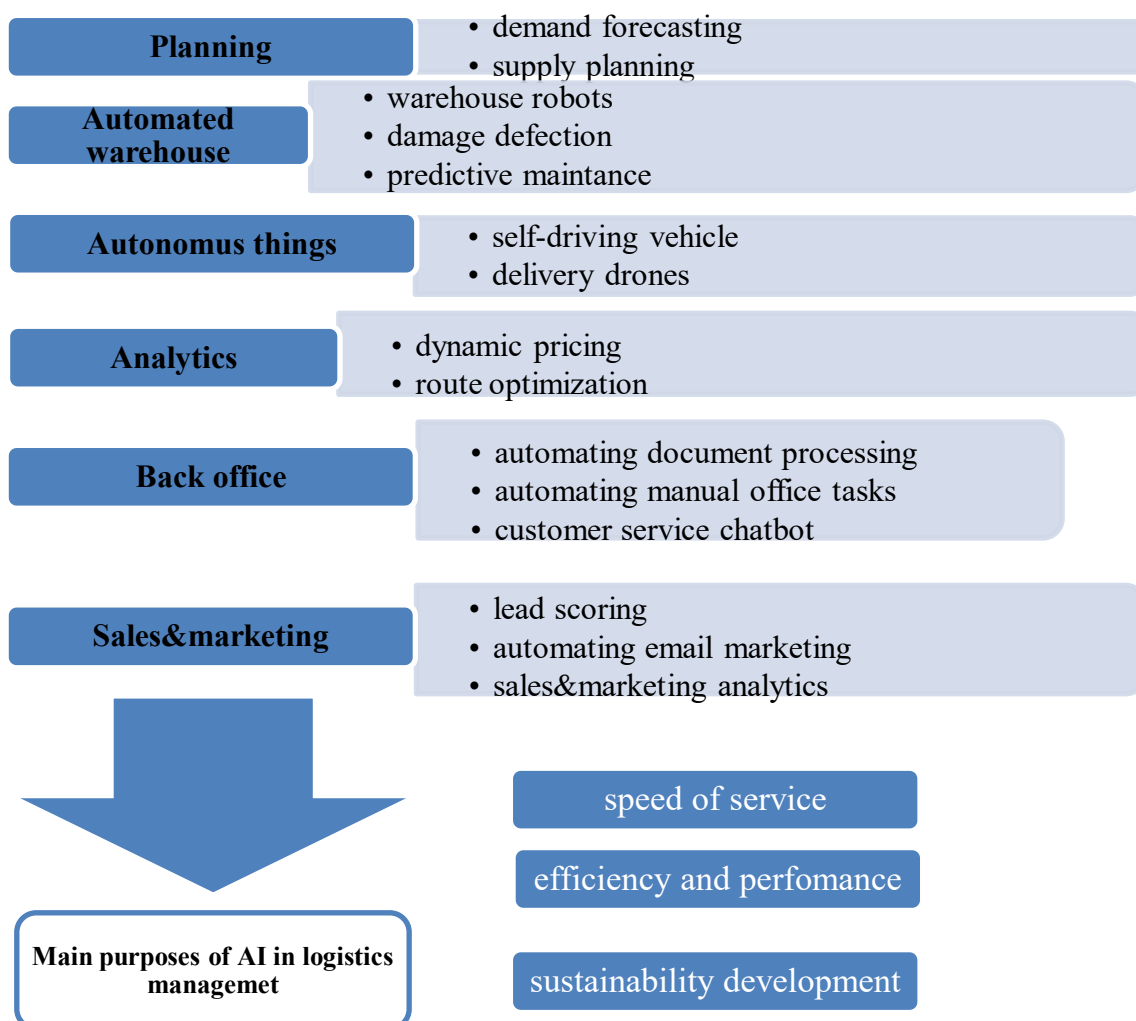
Planning
- demand forecasting
- supply planning

Automated warehouse
- warehouse robots
- damage defection
- predictive maintance

Autonomus things
- self-driving vehicle
- delivery drones

Analytics
- dynamic pricing
- route optimization

Back office
- automating document processing
- automating manual office tasks
- customer service chatbot

Sales&marketing
- lead scoring
- automating email marketing
- sales&marketing analytics

Main purposes of AI in logistics managemet

speed of service

efficiency and perfomance

sustainability development

Fig. 1. Use cases of AI in logistics management

(constructed by the authors based on sources [16-18])

Predictive Capabilities of AI have made demand forecasting [20] easier. When inventory is behind the demand schedule, businesses lose money. Network planning and demand planning [20] are becoming more efficient thanks to AI, which enables merchandisers to be more proactive. Knowing what to anticipate allows them to modify their stock levels and guide inventory to areas where they expect the most demand, resulting in lower operational costs.

Use Case «Shell Inventory Optimiser», a product that uses advanced analytics on historical data to optimize operational spare part inventory levels, was created in a collaboration between Shell and Equinor. Equinor expects this tool to reduce inventory inflow by as much as 13%, saving millions.

The goal is for energy companies to have better control over available equipment and to optimise stock levels. Since first deployment in 2017, this proprietary solution has been deployed across Shell's Upstream, Manufacturing and Integrated Gas assets globally, generating millions of dollars in value through optimized stock levels. Dan Jeavons, General Manager Data Science at Shell, says:

The collaboration to co-develop the next stage of Shell Inventory Optimiser with Equinor is an important milestone for both our companies; it speaks to the digital cultural and technical strengths we share, and our history of successful collaborations in the supply chain domain and the value we can achieve working in partnership. I look forward to further collaboration with Equinor in the supply-chain and decarbonization domain, with the continued support of our mutual partner Microsoft [21].

Smart Warehouse Systems are able to recognize patterns, regularities and dependencies from unstructured data by using the Internet of Things, artificial intelligence and cloud computing. They can then adapt, independently and dynamically, to new circumstances throughout the entire logistics system. As a result, monotonous jobs become simpler, and operations become more efficient and cost-effective.

Use Case Cainiao [22], the logistics division of Chinese e-commerce behemoth Alibaba, has declared the opening of business at its brand-new smart warehouse in Huiyang, Guangdong province. The warehouse has more than 100 self-charging, Wi-Fi-equipped AGVs (automated guided vehicles) to oversee transporting products. Alibaba claims that since the warehouse started operating in July, employee productivity has tripled.

In the last two years alone, the demand for smart warehouse solutions has soared to an all-time high. In fact, the smart warehousing market size [23] is expected to almost double, growing from US$ 14.8 billion in 2021 to US$ 25.4 billion by 2026.

To strengthen its logistic services under its «asset-light» business strategy, Alibaba invested $807 million, to increase its stake in logistics platform firm Cainiao Smart Logistics to 51 in Sep 2017 [24]. Instead of creating a courier service company, Cainiao Smart logistic is a Cloud and Big Data powered platform that connects 3rd party logistic partners with E-commerce Merchant to improve the overall delivery efficiency. Its goal is to fulfill orders on the mainland within 24 hours and within 72 hours globally [24].

By connecting logistic partners and the E-commerce Merchant – Cainiao platform feed real-time information to small merchants to choose the most efficient delivery option within a pool of delivery firms based on its location and type of goods. Cainiao's smart routing and sorting service also reduce logistics firm's delivery errors by 40%. In addition, it provides a real-time tracking system to enhance the information synchronization and transparency among logistic partners, Merchants, and Consumers. [25].

AI-Powered Route Planning can help the transport and logistics industries integrate data from various sources and make intelligent judgments regarding travel routes.

Use Case UPS developed Dynamic On-Road Integrated Optimization and Navigation technology (ORION) that uses advanced algorithms, artificial intelligence and machine learning and offers precise delivery time estimates, dependability and responsiveness. UPS has saved around 100 million miles and 10 million gallons of gasoline annually since ORION's first deployment in 2012.

UPS route optimization software (ORION) helps make many deliveries without any hassles. UPS delivers around 5.5 billion packages a year with the help of the 125,000 vehicles in its delivery fleet. The fleet consists of 10,300 «alternative fuel and advanced tech vehicles», representing a little under 10% of its entire fleet size.

Conversational Artificial Intelligence is present in user-interactive virtual assistants or chatbots [26]. The technology mimics human interactions by identifying speech and text inputs and translating their contents into other languages using massive amounts of data, machine learning and natural language processing.

Conversational AI provides regular updates and all relevant information about any delays, allowing for comprehensive visibility of the shipment. Additionally, by providing a 24/7 conversational interface, conversational AI is always available to provide users with the information they require.

Use Case BearingPoint, in collaboration with DHL [27], developed 'Marie' using Salesforce Service Cloud and Einstein AI to automatically resolve customer requests coming through chat. Customers got a seamless experience while agents were able to handle inquiries more effectively. Nearly one-quarter of respondents trust virtual assistant recommendations for product purchases rather than a human salesforce. 87.2% of consumers report having a neutral or positive customer experience with chatbots [28].

Computer Vision: The Computer Vision trend is set to highly impact logistics in the coming years. Its technology will underpin and drive future logistics, enabling more efficient processes as well as sustainable and safe operations.

However, more investment is needed for this trend to be fully realized. As experienced in the early days of sensor adoption, computer vision applications must be scalable for logistics organizations to maximize benefits.

HCL: Emerging from AI as a trend in its own right, Computer Vision has developed in conjunction with the advancement of deep machine learning, leveraging the rising quality and decreasing cost of camera devices. In 2020, the computer vision market globally was worth 9.4 billion USD and – as AI, vision systems, and computer processing continually improve – it is anticipated this market will more than quadruple to 41.4 billion USD in 2030.

Today, advanced computer vision technology is perfecting depth perception, 3D reconstruction, and dark and blurred image interpretation, all of which will unlock more opportunities in supply chains [29].

Autonomous Vehicles. DHL is working on autonomous vehicles on three fronts, including the development of intelligent robotic workers in its own warehouses and air freight centers; the use of semi-autonomous trucks in the line-haul business; and "follow-me" robots used for last-mile route delivery in urban settings.

One of the more interesting uses of AI is the development of truck platoons in Europe, where anywhere from one to four autonomous semi-trucks follow a lead truck with a human driver down

the road. By synchronizing acceleration, braking, and steering among the trucks, the platoon can boost freight capacity while minimizing costs, all without handing total control over to the AI program. DHL will be involved with testing a truck platooning in the UK next year with the British Transportation Research Laboratory and truck manufacturer DAF Trucks [30].

Resilience 360. DHL plans to infuse this cloud-based risk management tool with AI capabilities that will give its customers an early warning that something is amiss in their supply chains. This product uses sentiment analysis to monitor 8 million sources of data on the Internet, including social media, for anything that could signal a disruption, including unhappy customers and even labor unrest.

«For a lot of our B2B or automotive or manufacturing customers, they have very vast supplier networks», Gesing says, «we proactive identify risky parts of the supply chain so our customers can plan downstream more effectively».

Supply chain tracking. AI has been increasingly applied in supply chain management to improve performance in an Agile and Lean perspective. Many companies are investing in digital solutions to optimize their supply chain operations, depicting the global AI adoption rate in supply chain and manufacturing businesses. Literature has shown that AI can provide companies with the ability to respond quickly to changes in demand, reduce waste, and improve collaboration and customer satisfaction. The AI in 2022 was 11% adaptation and in 2025 it expects to be 38% [31]

Drone-based deliveries. The use of drones for deliveries looks very promising, especially for streamlining and automating goods transportation. At the moment this segment is being actively studied. Nevertheless, today is definitely not the best time to speak about the full-scale adoption or mass use of drones in this industry when it comes to long distances. Drones are good for in-house deliveries but with the growth of distances, it is not always reasonable and feasible to use drones. Moreover, many drones are simply not able to carry very heavy boxes and packages which also limits their use to some specific cases only.

The retail industry could become the first to start using such solutions as a standard delivery method. It is also forecasted that drones will make it possible to reduce operational costs and staff while increasing the quality of services and customer satisfaction. But with the growing interest in the application of drones from the side of companies working in many industries, including logistics, we can make an assumption that in the future, the situation will change.

Commercial Drone Market Worth USD 47.38 Billion by 2029 Increasing Demand for Small Drones in Commercial Applications to Propel Market Growth: Fortune Business Insights™, Growth Rate is CAGR of almost 28.58% 2022-2029, Revenue forecast is expected in 2029 USD 47.38 Billion [32].

Fleet management tools. Solutions of this type are often integrated into more complex systems. As companies can operate a huge number of vehicles, it's very important for them to accumulate a great deal of real-time information about the availability and state of each vehicle. Fleet management tools help companies better organize the entire workflow.

Fleet management solutions have a lot in common with software products that are built for location tracking. However, they can be used not only for monitoring the exact real-time location of trucks but also for tracking their technical state. Special sensors and devices can be installed on trucks and can continuously estimate the chosen parameters. Based on these parameters, logistics specialists can receive regular reports on the state of vehicles and on recommended timeframes for tech maintenance services.

106

The data from smart devices is sent to the defined servers where the company's employees can get access to them.

Ford is offering a new van fleet management service to large operators of its vehicles for free, claiming it can improve uptime by up to 60%.

Ford Telematics Essentials is the latest development of the FordLive system [33], which delivers 'smart maintenance' alerts based on real-time vehicle health data. The alerts help businesses to maximize uptime by reducing the number of breakdowns and achieving quicker servicing and repair times, it says.

Connecting vehicle data from the fleet, FordLiive also links businesses to the support available from the Transit Centre network through 'smart diagnostics' so that the productivity of each individual vehicle can be optimized.

Small business customers have already been benefiting from the FordLiive service through FordPassPro [33], which is generating 20,000-plus proactive service messages to customers every month.

Ford's larger fleet customers can now benefit from that same capability for free with the launch of Ford Telematics Essentials.

Mark Harvey, director for enterprise connectivity at Ford of Europe, said: "Ford Telematics Essentials is a desktop software tool that enables fleet managers to understand more about the health of their vehicles [34].

Enterprises can use fleet management to track and repair their cars in a cost-effective, timely, and accessible manner. Vehicle tracking and diagnostics, finance, driver management, and other activities are all part of it. It enables businesses that rely heavily on transportation to reduce or eliminate the risks connected with staffing, operations, and other factors. Fleet management benefits include lower fuel and overall operating costs, improved safety, and better fleet operations, as well as real-time fleet tracking and monitoring. According to the Automotive Fleet, sales of automobiles to business fleets in the United States climbed by 2.1 % to 69,145 in May 2019 compared to the previous year, according to Maximize market research statistics from the Automotive Fleet [34]. Rising operational expenses, owing to increased demand for utility vehicles, rising maintenance costs, and constant growth in compliance costs, have had a significant impact on the fleet management business

Conclusion. The study analyzes the application of AI in e-business logistics, characterizes the main trends in logistics management, and systematizes the directions for the effective use of AI in logistics. The result of research demonstrates that globalization is breaking all barriers and boundaries, enabling e-businesses to flourish. The industry that has benefitted and also been affected the most is logistics management. For it to operate seamlessly across the nations, it is important to keep up with the pace of technological advancements. Contributing greatly to the economy and increasing bilateral trade, the logistics management must be efficient enough to transport products so they are smoothly and quickly sent across.

The role of AI has become so prominent that it is almost indispensable to specific industries. According to Gartner [35], by 2026, more than 75% of commercial supply chain management application vendors will deliver embedded advanced analytics (AA), artificial intelligence (AI) and data science.

The future of AI in logistics management is likely to see several trends. AI is expected to become more widely adopted in logistics management as e-business recognizes its potential to

107

improve efficiency and reduce costs. AI systems are expected to become more seamlessly integrated with existing logistics management systems, allowing for more accurate data analysis and decision-making.

AI will play an increasingly important role in predictive analytics, enabling e-business to anticipate and respond to logistics disruptions and manage risk more effectively.

Today, in the conditions of war, it is important for Ukraine to apply the latest information technologies in the logistics of goods and services, which will ensure the sustainable development of the enterprise.

References:

1. Odell M. Logistics Trends for 2023: The top 5 trends in logistics (2023), Available at: https://www.tawi.com/insights/logistics-trends-for-2023-the-top-5-trends-in-logistics/

2. Hurtado PA, Dorneles C, Frazzon E (2019), Big Data application for E-commerce's Logistics: a research assessment and conceptual model. IFAC-PapersOnLine Volume, 52, 838-843. doi:10.1016/j.ifacol.2019.11.234.

3. Tran-Dang H., Krommenacker N., Charpentier P., Kim DS. (2022), The Internet of Things for Logistics: Perspectives, Application Review, and Challenges. IETE Technical Review, 39, 93- 121.

4. Huang George Q, Chen Michael Z Q, Pan Jia (2015), Robotics in ecommerce logistics. IETE Technical Review, 22, 68-77.

5. TOP logistics technology trends reshaping the industry in 2023 (2023), Available at: https://acropolium.com/blog/top-logistics-technology-trends/

6. Dekhne A., Hastings G., Murnane J., Neuhaus F. (2019), Automation in logistics: Big opportunity, bigger uncertainty. Available at: https://www.mckinsey.com/~/media/McKinsey/Industries/Travel%20Transport%20and%20Logistics/Our%20Insights/Automation%20in%20logistics%20Big%20opportunity%20bigger%20uncertainty/Automation-in-logistics-Big-opportunity-bigger-uncertainty-vF.pdf

7. Hackius, Niels, Petersen, Moritz (2017), Blockchain in logistics and supply chain: Trick or treat? Available at: https://www.econstor.eu/handle/10419/209299

8. Global elastic logistics market (2022), Available at: https://mobilityforesights.com/product/elastic-logistics-market/

9. Statistiken zu den Hauptanwendungsfeldern von KI (2022), Available at: https://de.statista.com/themen/3103/kuenstliche-intelligenz/

10. InData Labs 2023 (2023), AI in Logistics and Transportation: Data-Driven Shifts to Boost Business. Available at: https://indatalabs.com/blog/ai-in-logistics-and-transportation

11. Artificial intelligence in EU enterprises - Products Eurostat News - Eurostat (europa.eu) (2021). Available at: https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210413-1.

12. Global Transportation Management Systems (TMS) Market and Transportation Management Solution Market 2020 Insights by Top Players, Types, Key Regions, Applications, Growth Analysis, Future Business Opportunity, Demand & Forecast Rep. Available at: https://www.globenewswire.com/news-release/2020/01/28/1976025/0/en/Global-Transportation-Management-Systems-TMS-Market-and-Transportation-Management-Solution-Market-2020-Insights-by-Top-Players-Types-Key-Regions-Applications-Growth-Analysis-Future.html

13.	Straight B. 5 Transportation management system trends for 2020 (2019). Available at: https://www.freightwaves.com/news/5-transportation-management-system-trends-for-2020

14.	Artificial Intelligence is Driving Real Supply Chain Improvement (2020). Available at:	https://www.logisticsbureau.com/artificial-intelligence-is-driving-real-supply-chain-improvement/

15.	Brown T. (2020). Impact of AI in Supply Chain Management Available at: https://itchronicles.com/artificial-intelligence/ai-in-supply-chain-management/#Impact_of_AI_in_Supply_Chain_Management

16.	Succeeding in the AI supply-chain revolution (2021). Available at: https://www.mckinsey.com/industries/metals-and-mining/our-insights/succeeding-in-the-ai-supply-chain-revolution

17.	Joe Chmielewski, Michael Daher, and Ossama Ghazal (2021). The journey toward a touchless network through intelligent automation. *Deloitte Development LLC.* Available at: https://www2.deloitte.com/xe/en/insights/focus/transportation/the-role-of-intelligent-automation-in-the-movement-of-goods.html

18.	Sudeep Srivastava. How Is AI Revolutionizing The Logistics Industry: Key Benefits And Use Cases (2023). Available at: https://appinventiv.com/blog/ai-in-logistics-industry/

19.	AI use cases in the transport and logistics industry worldwide in 2020. Available at: https://www.statista.com/statistics/1197962/ai-transport-logistics-global/

20.	What us demand forecasting and how can it help your business? (2023) Available at https://www.gep.com/knowledge-bank/glossary/what-is-demand-forecasting

21.	Shell inventory optimiser (2020). Available at https://www.shell.com/energy-and-innovation/digitalisation/news-room/shell-and-equinor-announce-co-development-of-next-generation-of-inventory-optimiser.html

22.	Alibaba's Cainiao launches enterprise smart warehouse solution (2022). Available at https://techwireasia.com/2022/03/alibabas-cainiao-launches-enterprise-smart-warehouse-solution/\

23.	The global smart warehousing market size to grow from USD 14.8 billion in 2021 to USD 25.4 billion by 2026, at a Compound Annual Growth Rate (CAGR) of 11.5%. Available at: https://www.globenewswire.com/news-release/2021/10/12/2312220/0/en/The-global-smart-warehousing-market-size-to-grow-from-USD-14-8-billion-in-2021-to-USD-25-4-billion-by-2026-at-a-Compound-Annual-Growth-Rate-CAGR-of-11-5.html

24.	JD.com gaining on Alibaba's Chinese e-commerce market share (2017). Available at: https://seekingalpha.com/news/3293776-jd-com-gaining-on-alibabas-chinese-e-commerce-market-share

25.	Is Alibaba's Smart Logistic Platform Sufficient? - Technology and Operations Management	(harvard.edu)	(2017).	Available	at	https://d3.harvard.edu/platform-rctom/submission/is-alibabas-smart-logistic-platform-sufficient/

26.	Chatbots – the new frontline employees (2019). Available at https://www.gep.com/blog/mind/chatbots-the-new-frontline-employees

27.	Relevance to the Future of Logistics. Available at: https://www.dhl.com/global-en/home/insights-and-innovation/thought-leadership/trend-reports/ai-logistics.html

28.	Woodie A. How DHL Aims to Remake Logistics with AI (2018) Available at: https://www.datanami.com/2018/04/17/how-dhl-aims-to-remake-logistics-with-ai/

29.   Trend Overview (2022) DHL Group. Available at: https://www.dhl.com/global-en/home/insights-and-innovation/thought-leadership/trend-reports/computer-vision-logistics.html

30.   How DHL Aims to Remake Logistics with AI (2018) DHL Group. Available at: https://www.datanami.com/2018/04/17/how-dhl-aims-to-remake-logistics-with-ai/

31.   Artificial intelligence (AI) adoption rate in supply chain and manufacturing businesses worldwide in 2022 and 2025 (2022). Statista. Available at: https://www.statista.com/statistics/1346717/ai-function-adoption-rates-business-supply-chains/

32.   Fortune Business Insights (2022). Available at: https://www.globenewswire.com/en/news-release/2022/05/24/2448921/0/en/Commercial-Drone-Market-Worth-USD-47-38-Billion-by-2029-Increasing-Demand-for-Small-Drones-in-Commercial-Applications-to-Propel-Market-Growth-Fortune-Business-Insights.html

33.   New FordPass Pro app connects fleets (2019) Available at https://www.fleetnews.co.uk/news/latest-fleet-news/2019/09/25/new-fordpass-pro-app-connects-fleets-and-owners

34.   U.S. Fleet Management Market - Industry Trends and Forecast to 2029. Available at: https://www.databridgemarketresearch.com/reports/us-fleet-management-market

35.   Gartner Predicts the Future of Supply Chain Technology. Available at: https://www.gartner.com/smarterwithgartner/gartner-predicts-the-future-of-supply-chain-technology