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INFORMATION TECHNOLOGIES IN THE LOGISTICS INDUSTRY OF UKRAINE

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Abstract

The article analyzes the current state and outlines the main trends in the information technology development for the needs of the logistics industry. It is noted that the introduction of modern digital technology in logistics will not only change business models and strategic planning but also significantly improve the interaction between all participants of the logistics process, as well as increase productive efficiency and, consequently, increase the competitiveness of logistics companies. The expectable impact of the introduction of real-time technology, block-chain, artificial intelligence, digital counterparts and modern robotic engineering, 3D-modeling on the further development and the general environmental situation both in Ukraine and the world is described. The characteristics of fulfillment operators functioning in Ukraine and the main list of services they provide in the field of logistics are given, the geography of location of their main facilities in the country is outlined, which characterizes the places of greatest need for full range of logistics services.

Keywords: information technology in logistics, online logistics services, fulfillment service

Current trends in the development of the logistics industry are inextricably linked with the information technology development. Without properly organized logistics, goods distribution is impossible, and therefore today, during a pandemic that has exposed the crisis phenomena in all spheres of activity, the work of those enterprises that have internal supply chains of the closed cycle "production-consumer" remains relatively stable. The second current trend in the development of the logistics industry is the progress of e-commerce, business process automation and optimization of logistics processes in accordance with new market needs. The third trend is related to the development of production and consumption inside the country, i.e. creation of closed logistics supply chains and development of the domestic logistics industry. The formation and development of an innovative structure of the logistics system based on the use of modern information technology is an urgent requirement of today. The applied tasks of digitalization are to reduce time, labor, financial costs associated with data retrieval, as well as IT-applications for the formation of optimal business partnership layouts based on effective modeling of horizontal production-economic and trade-economic relations between different organizations-participants of the logistics process [1]. At present, we are witnessing a change in the global trend of logistics in Ukraine and the world towards sustainable and high-quality development. This contributes to the realization of the huge logistics potential of Ukraine, the transformation of logistics into a branch of the national economy, which will help the enterprises of our country to become more competitive and profitable in the world market.

Analysis of recent research and publications. Issues of application and development of information technology in the logistics sector were considered in the works of Anikina BA, Afanasieva NV, Ballow RN, Blanc IO, Volontyr LO, Gordon MP, Zalmanova MYe, Erickson D, Kalchenko AG, Christofer M, Krykavsky EV, Cooper G, Litvinenko VA, Moller S, Novikov OA, Porter M, Potapova NA, Hutchinson N, Shapiro RD, R.J. Schroeder RJ, Juhansson G, Hmil FI and others. But considering the rapid changes towards globalization and digital technological expansion, the logistics industry, like all others, is undergoing constant change and transformation.

The purpose of writing this article is a critical review of the current situation in the market of logistics services in Ukraine and the impact of modern information technology on its further development.

Presentation of the main research material. The main object of information logistics management is an information stream. In the production process, information stream operates at different management levels of the organizational structure. At the same time, it is transformed and developed depending on the material flows that accompany them in the logistics system. Information logistics operates with the amount of information generated inside the processes of movement, storage and sale of products (goods, works and services) at the enterprise. At the same time, information support should provide time modes of delivery,

controlling and monitoring for the movement of resources [2]. In recent years, the domestic market of logistics services has undergone qualitative changes – a change in philosophy and logistical thinking. Nowadays, many companies have realized that logistics is a real tool for improving business efficiency. Active involvement of Ukrainian enterprises in global supply chains, entry of domestic producers into world markets forced top management of industrial, agricultural, trade and service enterprises to pay attention to the logistics of their business, the organization of logistics processes (procurement, production, distribution), as well as to the possibility to reduce their logistics costs through effective cooperation (partnership) with logistics operators. The consequences of this change have been an increase in requirements for the quality of logistics services, guarantees for reliable delivery of goods, storage of consignment and transparency of business processes. As a result, companies can already note an increase in the level of organization, a significant increase in the

use of information technology, the complexity of logistics services [3]. Today, the logistics industry is undergoing rapid and unprecedented transformations, which is characterized by the constant introduction of innovations and technologies both in production processes and in the day-to-day life of consumers of logistics services. In the process of virtual and real-world merging, a mixed world is formed dominated by the Internet and augmented reality, and on this basis a total digitalization of all spheres of life appears including in the field of logistics [4].

The presence of a high level of competition among logistics campaigns requires them to use a wide range of technological solutions.

The latest logistics technologies are mostly aimed at increasing speed, accuracy, security and continuous delivery and use 3D printing, delivery of goods using unmanned vehicles and other elements of forward-looking reality.

If we talk about the use of 3D printing technology, its promotion in the field of logistics is associated with optimizing storage and delivery time of individual components, which will significantly reduce the use of warehouse space to store large stocks of finished products pending its orders.

The use of the Internet of Things technology in supply chain management to track goods and services on the way to their delivery allows one to track individual consignments and their condition using radio frequency identification (RFID) chips, which transmit information about the identification of cargo, its location, temperature, pressure, humidity, etc. This significantly increases the ability to quickly prevent damage or loss of cargo, change the optimal storage conditions and etc. Today, these technologies significantly increase customer satisfaction through the ability to track traffic patterns and estimate the delivery time of goods and its return.

The use of compact unmanned vehicles is widespread in some countries around the world and is under development in Ukraine. These technologies significantly optimize the time and cost of delivery of small cargo to hard-to-reach and remote areas but still need to address the issue of state regulation of this type of service, safety and weight and dimension characteristics of the unmanned vehicles themselves.

Vehicles without a driver, which are still being tested, have also shown great potential as a logistics tool. Their use will allow transport and logistics companies to reduce the cost of drivers and freight forwarders, reduce delivery time over long distances due to the lack of need for drivers to rest on the road.

Cloud technologies have long and firmly entered our lives, but the field of cargo transportation in our country is still far from large amount. The experience of Truckloads or Uber Freight proves that users of electronic platforms are no longer satisfied with just a response from a potential carrier to the order. Consignor shippers want a turnkey service, in other words door-to-door delivery of goods without.

leaving the desktop. The greatest prospects for the use of cloud storage systems are expected in warehousing. Such logistics operations account for about 20% of all logistics costs, and the task of compiling screening information is from 55 to 65% of the total cost of warehousing operations [5]. This indicates that the use of cloud storage systems can significantly reduce costs by improving the recruitment process, help train new or temporary warehouse staff, and promote better planning of cargo disposition in warehouses.

Equipping the staff of logistics companies with innovative information technology devices can increase the safety of activities and improve the quality of contact with consumers of logistics services [6]. For example, based on the application of "face recognition" technology, the customer who receives the parcel / cargo can be identified without the need to present any additional personal identifier. The device can take a snapshot and automatically compare it with photos from a protected database in a cloud information system. However, due to data privacy issues, the recipient shall be given prior permission to use this "face recognition" technique.

Modern online services for cargo transportation, as one of the new technological answers to modern challenges in the field of logistics, are ready to provide a number of opportunities:

- ✓ receiving a deferral of payment for cargo transportation services for up to 90 days;
- ✓ online insurance of most cargo without inspection;
- ✓ fully automated document control – from the application to the receipt of the consignment note, verification of business partners and actual contractors including drivers according to the standards of bank security services;
- ✓ guarantees of a secure agreement in terms of cash flow and return of reporting documents from carriers;
- ✓ no fees and no payment for the use of carrier search capabilities.

This is only a non-exhaustive list of online logistics services for transportation carriers available today. Side effects for business from such a transition to digital technologies include optimizing the number of line personnel involved in performing corporate logistics tasks; reduction of labor costs and time savings, the ability to work with long-term money. The most important thing in an era of turbulence and declining business income is the exception that erode the profits of intermediaries as an endangered link in the cargo transportation chain.

Modern online logistics service is not only a tool for solving the problems of consignor shippers. Private carriers and transport companies are provided with their own set of tools for business development:

- ✓ free access to the database of applications for cargo transportation;
- ✓ online notification of new applications in real time taking into account the parameters of the filters: direction, rate, type of cargo and many others;
- ✓ the possibility of receiving an advance on fuel on the day of loading;
- ✓ security of payment for the transportation performed at the expense of preliminary reservation by the prepayment service by the consignor shipper;

- ✓ the ability to monitor and manage the execution of applications and the number of drivers through a free mobile application;
- ✓ nonavailability of difficulties with the return of consignment vouchers as a condition for payment for the work performed.

It only remains to make a decision: to continue to work with receivables, return of documents and risks of non-fulfillment of applications by force of habit or to switch to logistics generation 2.0.

I.V. Shevchenko [7] have systematized the main problems and prospects for innovation in logistics (Table 1).

Table 1

Problems and prospects for the introduction of innovations in the logistics activities of domestic enterprises

Problems of introduction of innovations in logistic activity of domestic enterprises	Prospects for the introduction of innovations in the logistics activities of domestic enterprises
imperfect regulatory and legal framework of the state	providing an innovative way of development of the domestic economy
limited access to information on domestic and foreign experience in implementing innovations	gradual formation of the innovative stage of activity development of the enterprises in the strategy of logistic transformations
lack of financial resources of enterprises	gradual involvement of the enterprises in the global logistics market
management of enterprises having the existing stereotypes	giving companies the opportunity to compete in the global logistics market
lack of trust in innovative product	support for priority areas of innovation and logistics activities of enterprises
risks that accompany the introduction of innovations	promoting the development of innovation and logistics infrastructures
insufficient qualification of the staff	increasing the degree of protection of the rights and interests of the subjects of innovation and logistics activity

The leading component of innovations in logistics is modern information technology as logistics communications are an important link in logistics systems. Technological innovations are playing an increasing role in all sectors of the economy, and therefore logistics and supply chain management cannot be left out of this process. Innovations in the logistics sector are not only related to the desire of logistics companies to introduce new technologies in order to keep up with the development of the industry. To a large extent this is required by the customers of logistics specialists – representatives of trade companies and large industrial enterprises who need their products or services to come faster and at lower cost. Let us consider what innovations will largely determine changes in logistics in 2020-2021.

1. Real-time supply chain management. The real-time supply chain has ceased to be a "technological highlight" or a "miracle" in logistics: in 2019 it began to be implemented by many companies, and in 2020 it became necessary for almost all companies. Real-time data is now becoming more in demand by more and more customers, which means that logistics and supply chain management companies will need to focus on it. There are now a large number of startups whose solutions ensure the transparency of the supply chain, provide it with technology that facilitates rapid response to change, allowing companies to use real-time data.

Such data include traffic patterns, weather conditions in a particular area up to the condition of roads or access roads to ports, which allows to optimize delivery routes. In 2019, studies showed that logistics companies that use fully integrated supply chains are 20% more efficient than their competitors.

We can't talk about supply chain management without mentioning the Internet of Things (IoT) technology, which is the most important asset for supply tracking today. Connecting an IoT device to different areas allows warehouses to track the movement of equipment, vehicles, and goods through cloud services. At the same time, IoT-based container management is simplified through real-time monitoring, fuel use efficiency, preventive maintenance and intensification of container operations are also increased.

Due to this, another trend will probably be closer cooperation between IoT startups and logistics companies. One of the most recent examples is Hapag-Lloyd, which chose the IoT Globe Tracker startup to create its own new real-time container monitoring system called Hapag-Lloyd Live.

2. The growing importance of new models and new players in the market of logistics services. The future of logistics is shaped not only by new technologies: no less important is the role of new business models and new players in the industry. Increasingly, startups, new systems that incorporate elements of the sharing economy are being launched, and they are rapidly gaining popularity.

With little experience in logistics assets, startups tend to focus on the "easy" parts of the supply chain, becoming, for example, digital freight forwarders. Thanks to more flexible operations, they can offer more attractive prices while ensuring the transparency of the logistics process.

This also applies to Uber, which launched its Uber Freight function in the United States in 2017 and expanded to Europe and Canada last year in pursuit of a more efficient global trucking market. Uber Freight, according to Uber, is one of the most promising projects.

Even our own logistics customers see the potential in freight forwarding: Amazon plans to expand its own experience in warehousing and transportation to develop its own delivery capabilities. The company has already made great strides with the development of Prime Air, an unmanned aerial vehicle service, which it develops to create fully electric remote-piloted vehicles capable of flying up to 15 miles and delivering parcels weighing less than five pounds to customers in less than a 30 minutes period of time.

In addition, it is reported that the company imports new intermodal containers under the Amazon brand from China. The company also announced the Amazon Flex platform, which uses on-demand contract drivers to accelerate the expansion of Prime One Day program.

Amazon has also announced its new robotic products, which are sent to hundreds of service centers around the world. One such product is the Pegasus sorting system, which has now covered more than two million miles and has already reduced the number of incorrectly sorted goods by 50%, while maintaining the safety features of the existing transportation system.

3. Robotization of warehousing operations. In recent years, warehousing operations have undergone significant changes together with the gradual integration of technology, this is one of the trends in logistics technology, which is likely to be preserved. One of the obvious innovations is also warehouse robotics, and this area is developing rapidly.

According to the Global Customer Report 2019, in-warehouse robotics testing has increased by 18% compared to last year. Boston Dynamics' mobile warehouse robot called Handle is one of striking examples: the company has developed a fully autonomous compact device that can access any of the hard-to-reach places, while having an extended viewing area. Thanks to these functions, the robot can quickly unload trucks, stack pallets and move boxes throughout the warehouse. Both technology carriers and driverless vehicles or multifunctional works can also increase the efficiency and speed of warehousing processes.

For example, GreyOrange and Locus Robotics already use robots that move around the warehouse on their own. Thanks to machine learning technologies and sensors that provide maximum accuracy and ease of tracking, a large number of autonomous robots have appeared in modern warehouses in 2020.

4. Artificial and augmented intelligence). Over the past few years, the logistics industry has begun to integrate artificial intelligence solutions into its operations, which include solutions for intelligent transportation, route planning and demand planning, and this is just the beginning. It is likely that shippers, carriers, suppliers and consumers will be able to benefit from these trends in logistics technology, which will continue in 2021. Along with artificial intelligence, the augmented reality and augmented artificial intelligence will probably be used no less actively.

Advanced artificial intelligence combines human intelligence with automated artificial intelligence processes. For example, in logistics planning, the use of enhanced intelligence may even surpass the use of artificial intelligence alone, as it combines human capabilities (experience, responsibility, customer service, flexibility, common sense, etc.) with artificial intelligence technology, which will perform repeating actions and hard work.

According to Gartner Company, expanded intelligence will have create $ 2.9 trillion in business value and increase productivity by 6.2 billion hours globally by 2021.

Logistics companies can be expected to implement more intelligence-enhancing solutions that will ultimately allow logistics professionals to do their jobs faster, reducing errors and saving money.

5. Digital duplicates. Digital duplicates or digital copies of a physical object or process are perhaps one of the most exciting trends in logistics technology to watch in 2020-2021. Many logisticians know that products will never be the same as their computer models. Modeling in its current state does not take into account how parts wear and how they are replaced, how fatigue accumulates in structures or how owners make changes according to their changing needs.

However, digital duplicate technology is changing this once and for all: now the physical and digital worlds can be combined into one, allowing us to interact for the first time with a digital model of a physical object or its part in the same way as their physical counterparts. The potential use of digital duplicates in logistics is huge. In the transportation sector, digital twins can be used to collect product and packaging data and use this information to identify potential shortcomings and recurring trends to improve future operations.

Warehouses and businesses can also use this technology to create accurate 3D models of their centers and experiment with layout changes or the introduction of new equipment to see their impact. In addition, logistics centers can create digital twins and use them to test different scenarios and increase efficiency. It is also worth noting that delivery networks could use this technology to provide real-time information that will improve delivery times and further assist autonomous vehicles on their routes.

6. Blockchain. Since its inception in 2008, the blockchain has become one of the loudest words in any industry. Unfortunately, the complex concept of the blockchain is difficult for many logisticians to understand, and despite its great potential, it has hardly developed. In addition, many logistic experts are tired of the very frequent use of this term. As you know, a blockchain is an "open book of transactions" distributed between computers on a network. Because everyone in the shared blockchain has access to the same register of transactions, there is complete transparency, which prevents users from hacking into the system and thus eliminates the need for third parties.

In the logistics industry, the blockchain can simplify the exchange of confidential data for different carriers or consignor shippers; companies could create trade finance solutions and supply chains. Today, there are already experimental projects that successfully use the blockchain in logistics. For example, CargoX is one of the startups that is fully committed to implementing the blockchain in the logistics industry using the public

Ethereum network for secure document transaction checking. Warren Buffett's UPS and BNSF Railway have also joined the blockchain in the transport alliance. Another example is a joint venture between Maersk and IBM on a blockchain called TradeLens.

Currently, five of the world's six largest carriers have joined the platform, and more than half of the world's shipping containers are currently traded through TradeLens. But in order to effectively accept the blockchain, logistics companies need to digitize, standardize, and clean up their data. This will introduce an industry-wide standard and create a supply chain ecosystem to use the standard in a common, unresolved blockchain environment.

7. Data standardization and advanced analytics. Traditionally, data in the field of logistics have always been completely different. Companies store data in any place convenient for them and in a program convenient for them, which leads to a fragmented ecosystem, inefficient operation and complicates the digitization of operations. One of the most interesting trends in logistics technology in 2020, indicates that data-warehousing system will no longer be suitable for companies that want to keep up with the changing times.

For example, new data standards are finally being created in the field of container shipping thanks to the advent of the Digital Container Shipping Association (DCSA) in 2019. DCSA's mission is to create common information technology standards for digitization and interoperability to make the delivery sector more efficient for both customers and shipping lines. Only a few months after its launch, the organization released its first industrial project, which details new industry standards for the data processing procedures used in container delivery. However, DCSA represents only a movement to standardize data in the container transport sector, and the association will need time to develop new standards covering different sub-sectors of transport. Meanwhile, Traxens, an IoT company that provides valuable data and services to the supply chain industry, has announced that it has taken over the leadership in the development of the first standards for smart container exchange. Other areas of logistics still have to work hard to address data inconsistencies, forcing many young startups to focus on building forecasts and enhanced analytics platforms as new solutions. These logistics startups help large companies clean and digitize their data, enabling them to then use that data for advanced analytics and forecast optimization. They include improved supply chain visibility, demand forecasting, forward line planning, forecast service, unpredictable conditions, and improved last mile delivery. When the data is standardized and digitized throughout the logistics industry, all companies will be able to reap huge benefits.

8. Autonomous vehicles. Although autonomous vehicles – whether driverless trucks or unmanned flying vehicles – are closely linked to the near future of logistics, we are likely to see it only in the testing phase in 2020-2021. However, this is one of the most discussed trends in logistics technology in recent times. For example, UPS Ventures has invested in an autonomous car company TuSimple. Both companies are testing unmanned dump trucks in the United States to determine if these vehicles can improve UPS service and efficiency. This means that UPS and TuSimple are joining companies such as Daimler, Tesla, Starsky Robotics, Einride and Embark, which aim to ensure that trucks deliver goods without human assistance.

As use of more and more drones are considered for small package delivery, it is not surprising that in 2020 there will be more test launches and pilot projects. In fact, Alphabet's Wing, the first officially approved unmanned aerial vehicle in the United States, has already made its first delivery last year, and UPS may well be the first company to operate drones nationwide.

9. Increased investment in logistics startups by venture funds. In 2019, venture firms have invested heavily in promising logistics startups. Flexport's famous investment of more than $ 1 billion has been mentioned before, but that's not all. In San Francisco, KeepTruckin, which operates truck fleets around the world, received $ 149 million in D-Series funding. Another striking example of this trend is Atlanta-based Roadie, which has invested $ 37 million in Warren Stevens' Home Depot retailer, as well as former Alphabet CEO Eric Schmidt and other investors.

In turn, Postmates food service received about $ 1 billion in investment, with a potential estimate of $ 2.4 billion. At the same time, in the warehousing industry, as already mentioned, the creator and leader in warehousing, FLEXE received $ 43 million in Series B funding.

Many venture funds have invested millions of dollars in new technologies developed by innovative startups, or even acquired them themselves. In this way, logistics companies can now use their capabilities to conduct research and development through their new partners. Giants such as UPS see great benefits in such close collaboration: in early 2019, the company made a small investment in car company TuSimple to test self-propelled cars with trailers in Arizona and see how they can enrich its experience.

Maersk also have recently announced that it is joining other shipping giants CMA CGM and MSC to invest capital in Traxens, a data and services platform for the supply chain industry. It is important that e-commerce players also want to take part in this race: for example, the multi-channel trading platform Shopify has acquired River Systems, a provider of joint warehousing robotics solutions. The rush for innovation has also induced Singapore's National Welfare Fund Temasek to partner with transport giant Kuehne + Nagel to create a $ 50 million venture fund for logistics and supply startups. There are also companies that want to expand their technology portfolio on their own. For example, C.H. Robinson Worldwide, North America's largest freight broker, has announced it will double its technology spending to $ 1 billion to expand and grow its services by competing with digital startups. In addition, in an effort to adapt quickly to digital innovation, Deutsche Post DHL Group announced in October 2019 that it plans to invest $ 2.2 billion in digital initiatives by 2025. Given that so many partnerships have been

established over the last year, it will be interesting to see what decisions are the result of these investments.

10. Sustainable development based on technology. Sustainable development is a trend that permeates all industries, and logistics is no exception. In particular, last mile delivery traditionally requires a lot of time and energy, so it also provides many opportunities for fresh and smart approaches. To reduce the negative impact on the environment, companies use a variety of technologies, from real electric vehicles to artificial intelligence software that calculates the route with the lowest emissions.

Amazon recently announced its *Climate Commitment*, which aims to achieve the goals set out in the Paris Climate Agreement 10 years earlier. Thus, the company hopes to encourage other companies to join it, as well as to become a company that does not use cars and other mechanisms that emit carbon dioxide into the atmosphere and instead promote renewable energy sources by 2040. To do this, Amazon has signed a contract to launch the Rivian electric car to supply 100,000 electric vans.

Deutsche Post, the world's largest courier company, has also allocated $ 552 million to light electric trucks and microelectronic devices. The partnership with the Chinese manufacturer will create up to 100,000 street scooters a year. Similar trends in logistics technologies are observed throughout the transportation sector. More recently, more than 60 commercial groups, including Maersk, have taken the initiative to use zero-carbon ships and marine fuels on the high seas by 2030. These efforts are fundamental not only because of their direct impact but also because they inspire the entire industry to adopt a more resilient thinking concerning the environment.

If we talk about the characteristics of the logistics industry in Ukraine, it is worth noting the rapid increase in fulfilment operators in Ukraine, which also constantly improve the range of services and promote the introduction of modern technologies to better meet the needs of consumers. Fulfillment service is the transfer of all procedures for processing orders and sending them to end users for outsourcing. It is executed from the moment of ordering until the moment of delivery of this order to the client. Thus, the companies that provide the service assume full responsibility for receiving and processing orders; receiving payment from customers; storage of goods in warehouses; complete set and packaging of products; transportation and transfer of parcels to consumers; return logistics.

Despite the fact that the company's fulfillment is a relatively young format of logistics outsourcing in Ukraine, this area is developing and growing rapidly. Fulfillment centers are being rebuilt in large Ukrainian cities. At the moment in Ukraine there are less than 10 companies that provide the service, among the most popular are Zammler, "Nova Poshta", Ekol, Denka Logistics and others. The most popular fulfilment is in Kiev and regional centers. The geography of Ukrainian fulfillment operators is quite diverse, however, given the location of the main warehousing facilities, they are mainly concentrated in the cities of Kyiv, Odessa, Dnipro, and Vinnytsia and Khmelnytsky regions.

Table 2 provides a brief description of the largest fulfillment operators operating in Ukraine.

Table 2

Characteristics of fulfillment operators in Ukraine

Name of fulfilment operator	Segment of activity in which services are provided	List of basic services provided	Availability of own warehouses	Cooperation with logistics companies
NP Logistics	B2B, B2C	fulfilment, 3PL, cross-docking, other warehousing services	Class A professional warehouse	Synergy with Nova Poshta Group companies
Meest China Fulfillment Warehouse (Poland)	B2B, B2C	Delivery of commercial cargo from China to Poland - air / railroad / sea. Storage of a consignment at a customs warehouse in Poland. Formation and collection of ready parcels under customer orders. Delivery of the order personally from hand to hand of the client in Ukraine.	Class A + professional warehouse	Collaboration with Meest Express
Unipost Fulfillment	B2B	Reception and storage of goods Complete set and packing of orders Transfer to delivery	-	Cooperation with Nova Poshta, Ukrposhta, Justin
Sender Ukraine	B2B	services of reception, storage, sending of goods to clients across Ukraine	-	Cooperation with Nova Poshta

Agro-Soyuz-Terminal	B2B	acceptance of goods in the warehouse, processing, accounting and storage; reception and processing of online store orders; formation of orders, if necessary – marking of packing by company labels, stamps with a company logo, etc.; organization of delivery of orders to recipients by own forces, through partner services, customer pickup, etc.; acceptance of payment for the goods; work with returns, damaged goods, etc.	Own warehouses near Dnipro city	-
Euro-Asian logistics company	B2B	transport logistics and warehousing logistics, customs services, cross-docking operations, fulfilling, planning and design of all delivery links	Class A + professional warehouse	-
MTP Group	B2B	Concluding agreements, receiving goods; storage and accounting of goods; collecting, sending customer orders; returned commodity processing; daily reporting	Professional warehouse	-
Teleport Plus	B2B	responsible storage of goods; call center for clients; fast order processing; packaging and shipping of goods; processing and redirection of returned commodity; work under a formal agreement	Professional warehouse	Cooperation with Nova Poshta and others
FLF Fulfilment	B2B	Warehousing and outsourcing	Professional warehouse	Cooperation with Nova Poshta
Express Moto Ukraine	B2B, B2C	optimal delivery, after-sales service according to customer's request, stock control, shipments for buyers	Professional warehouse	-
IGLAR Logistics	B2B	Warehousing services; Loading and unloading works; Analytical reports; Sorting and completing orders; Turnovers, warehouse balances; Cargo packing for storage and transportation; Sales statistics and profitability of goods; Address collection and cargo delivery; Commodity system software; Placing a workplace under certain employee; Procurement and warehouse accounting; Cargo insurance for the period of transportation and warehousing; keeping track of the dynamics of revenue and balances of goods and at outlets. Inventory and accounting of product balances;	Professional warehouse	-
MOEZ GmbH	B2B	Warehousing, delivery, work with returned commodity and additional services Customer support in English, German, Ukrainian or Russian Ensuring storage in major cities of Ukraine – Kiev, Odessa, Dnipro Software compatibility Support and connection of the most popular software in Europe, CMS, etc. Payment management is possible in Ukraine Delivery from the EU with the necessary customs clearance in Ukraine Exclusive additional services Close partnership with supplier companies in Ukraine.	Professional warehouse	Cooperation with Nova Poshta, Ukrposhta and others

Mybox Fulfillment	B2B	acceptance of goods, sticking, damage check optimization, warehousing processing and completion of orders, packing and repackaging of goods, forming sets, transport packaging, inventory, analysis and inventory management recommendations, media and photo studio	Professional warehouse	-

Conclusions. Analysis of current trends in the field of information technology, which are of interest to an increasing number of representatives of the logistics industry allows us to speak about the significant impact on the transformation processes in this industry. Investing in startups that relate not only to purely logistics processes but also to the overall development of production processes and interaction with consumers indicates the significant interest of multinational companies in improving the storage, transportation and service of goods, reducing customer service costs and identifying their needs. In the era of global innovative changes in the society, companies seek to realize all the potential benefits of the effective use of information technology in logistics.

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AN ERROR OF DIGITAL INTEGRATOR OF SEQUENTIAL CARRY INTERPOLATOR IN TASKS OF COMPUTER GRAPHICS

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Abstract

A study and analysis of features of recreation of segments of straight lines are undertaken after the method of digital differential analyzer in a linear interpolator, the errors of DDA and 2-dimentions linear interpolation are certain with the use of digital integrator of sequential carry.

Keywords: computer graphics, graphic information, line, 2-dimensions linear interpolation, error, digital differential analyzer, digital integrator of sequential carry, pulse rate multipler

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Computer graphics allow to use the most evident presentation of information in a graphic kind in different industries of human activity. Actual enough is a task of choice of facilities of computer graphics, namely devices and facilities recreations of graphic information, that provide necessary quality and fast-acting graphic picture generation without the increase of hardware costs with sufficient authenticity of recreation of graphic information. The most widespread elements of the two-dimensional (2D) and three-dimensional (3D) graphic stages are flat grounds, triangles and segments of straight lines [3, 6]. As a task of recreation of grounds and triangles (both filled by a color and contour [4, 6]) can be broken up on the row of tasks on the recreation of segments of straight lines, then it is possible to consider the segment of straight line the basic element of images.

Raising of task. Among the methods of linear interpolation on the recreation of segments of straight lines most distribution was got by the methods based on the use of digital integrators of sequential carry, and methods that is based on the use of digital integrators of parallel transfer or with the calculation of criterion function, Bresenham's line algorithm (BLA) [3, 4].

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