THE IMPACT OF DIGITIZATION OF THE ECONOMY ON CHANGES IN SUPPLY CHAINS IN MODERN CONDITIONS

Svitlana Koliadenko[1]
Svitlana Kiporenko[2]

DOI: https://doi.org/10.30525/978-9934-26-286-9-1

Abstract. In the conditions of the rapid development of modern society and the changes taking place in the existence of economic systems of production, consumption, and especially the distribution of products, services, information, etc., the issue of implementing tools for digitization of economic processes that will help avoid or reduce the negative effects of new challenges require much greater attention for world society (including such urgent ones as global warming and environmental pollution, and in recent years, crisis factors have also been added: the COVID-19 pandemic (from 2020 and the start of hostilities in Ukraine from February 2022)), in particular, in logistics processes, the important components of which are supply chains.

The purpose of the study is to substantiate the theoretical and applied principles of the influence of the processes of digitization of the economy in Ukraine and the world on changes occurring in supply chains in modern crisis conditions. The subject of the study is the theoretical, methodological and practical aspects of using supply chains in logistics processes for economic development, taking into account the processes of digitization of the economy.

Methodology. The following scientific methods were used in the study: monographic (when studying the theoretical provisions of the processes of digitization of the economy, which take place in supply chains); statistical (when analyzing the rating of the world's largest 3PL providers, the state

[1] Doctor of Economics Sciences,
Professor Department of Computer Science and Economic Cybernetics
Vinnytsia National Agrarian University, Ukraine
[2] Assistant of the Department of Computer Science and Economic Cybernetics
Vinnytsia National Agrarian University, Ukraine

of the level of use of information and communication technologies at Ukrainian enterprises); methods of economic and statistical research (statistical observation, comparison, tabular, graphic) – when developing visual illustrations; abstract-logical – for summarizing research results and formulating research conclusions.

Results. The specifics of the innovation environment and its use as a basic element for the introduction of digitalization processes in supply chains are considered, and the stages of the formation of the innovation environment of enterprises, which will be basic for the creation of the actual supply chains, are determined; the need to use tools for digital transformation of the business model of supply chains using the identified global trends in the development of logistics and supply chains for the future and adjusting them to solve more urgent world problems (global warming and greening) is substantiated, which is especially important when the world economy enters the so-called third wave of globalization, which will facilitate, thanks to the development of the digital economy (and precisely the processes of digitalization in it), small and medium-sized businesses to get a previously unavailable opportunity to become global, to join supply chains and the world economy, i.e. the third wave will take place thanks to individual, first of all, small companies, and each of them cannot and it is not appropriate to develop digital supply chains, they are already developed and should be used by such companies; established relationships between the use of modern supply chains and tools for their improvement, developed in the process of digitalization of economic processes, using examples of modern global logistics companies for implementation in Ukraine, with the involvement of Ukrainian IT specialists. The modern influence of the digital economy on globalization was studied and some trends and consequences of this influence were identified, which can positively affect the further development of the IT industry in the world economy and Ukraine, especially the development of small and medium-sized enterprises – the basis of economic development for the near future and the main drivers – logistics transformations, where the leading role belongs to supply chains, especially at the moment of the beginning of the predictable, but rather complex global economic crisis, at a time when new, unpredictable challenges are coming.

Practical implications. The impact of digitalization of the economy on changes in supply chains in the current crisis conditions is analyzed. Measures are proposed to promote the development and improvement of supply chains in Ukraine to ensure the effective use of logistics processes.

Value/originality. The theoretical and methodological justification of the management of supply chains in the conditions of digitalization of the economy and proposed methods and models of management of supply chains in the conditions of digitalization of the economy are developed. The issues of the innovative environment as a basis for the formation of supply chains are studied. The current state of use of supply chains in the post-war and war period is analyzed. The role of the digital economy as a prerequisite for the creation of modern supply chains is defined. Generalized issues of development and use of IT solutions in logistics and supply chains in modern economic conditions in Ukraine and the world. The research is based on the tasks of applied research on the topic: «Management of supply chains in the conditions of digitalization of the economy», state registration number 0121U109445. One of the key points of our research is that continuous movement towards perfection requires constant control and improvement of management decisions at the enterprise. Achieving the outlined goal and tasks is possible on the basis of IT technology for logistics needs. Many global companies study such needs, develop and implement IT projects in the economic activities of many countries, while benefiting from the fact that such developments are close to universal, they are successfully used by specialists in logistics processes, this approach is especially important in agricultural industries and supply chains of agricultural products, because agricultural products and products of their processing are goods that «travel» around the world, creating extremely complex supply chains.

1. Introduction

Cyclicality in the development of multi-vector world processes leads not only to an increase in its level, but also to its deterioration, in accordance with classical economic laws. Today's decline in development is not only a consequence of the economic, even more so the global and social standard of living of society, but also economic and political instability, the emergence of military conflicts and hostilities (as in Ukraine), large-scale environmental

and natural disasters – it is perceived not as a cause, but as consequence of such transformations. Obviously, as interpreted by the macroeconomic theory of cyclical development, a recession should be followed by an upswing in development, and already at this stage the most important role will be played by the development of the economic sector, and if the recession has captured almost the entire world, then the recovery should take place on the scale of the maximum possible coverage most countries of the world. In this version, the economic revival will be faster, more efficient and global. In order to quickly restore the process of sustainable and stable development of the economy on a modern global scale, a fast, but stable and permanent transformation of business processes is needed in accordance with the changes currently taking place in most countries of the world. This also applies to Ukraine, where, in addition to various transformations in business processes, the economy is also undergoing changes due to other reasons: Russia's military aggression on the country's territory; the impact of the consequences of the pandemic, which are still felt in the economy; political and environmental instability; the consequences of global warming, which, among other things, leads to a significant increase in carbon content, a sharp decrease in water reserves, etc. It is obvious that the prompt solution of the set tasks is not possible without the use of economic science, which is not only pure economics, but a concentrated expression of all areas of research related to it, its components and derivatives, which, for example, are the processes of the digital economy. The direct implementation of digital technologies in all spheres of life is digitization (or digitization), which is designed to contribute to the sustainable development of the world economy and individual countries.

We absolutely agree with the opinion of M. Zhelikhovska [1], who indicates that the digital potential of logistics is the ability of the logistics system or any of its functional areas to implement (generate) or reproduce (perceive) certain digital innovations (technologies, platforms, products, etc.) for the first time. Elements of digital potential are new digital technologies; analytics and modeling; supply chain segmentation; service orientation; optimization of supply chains; increasing stability.

The classical economic process is based on its three components: production, distribution and consumption; in the modern economy, the processes of production and consumption have already been studied quite

fully and in detail, while the process of distribution was not paid enough attention until recently, especially in terms of delivery (logistic movement) of raw materials, goods, products, information, etc., and this occupies a rather significant place in all processes in general. The scientific study of logistics in the context of digitalization has become relevant and in demand in the modern social environment, especially in the part of studying supply chains. Researchers pay key attention to such an aspect of study as supply chains in their digital sense, and the application of scientific developments on this issue in terms of the combination and joint impact of information technologies, innovations, logistics, ecology, etc.

The world economy with its rather high level of globalization in the current conditions will no longer be able to get out of the current global crisis in parts (such parts can, for example, be considered separate continents or industries), the exit condition may be, if not simultaneity, then at least with small deviations in times. In the current situation, this problem can be solved only with the use of digitalization tools developed by modern scientists and IT practitioners of Ukraine and the world. The key unifying factor can only be logistics, which will use digital technologies that will ensure the quick delivery of goods, services, and especially information, etc. instantly to any place and at any time. Constituent links in this process are supply chains (delivery), which are based on digital technologies.

As Zhelikhovska M. [1] notes in her work, every aspect of business can be transformed by implementing a wide range of digital technologies: cloud solutions, big data, augmented reality, etc. Together, these processes make it possible to create new and improved business models, transform and integrate each individual link in the organization's production and sales chain. Smart warehouses were tested by employees of the DHL company, who tested augmented reality technology at one of the warehouses in the Netherlands – it used «vision sampling» when employees wore smart glasses and walked through the warehouse with the help of graphics. This helped reduce the number of errors and speed up the picking process by 25%.

These questions are quite relevant in the modern world, which almost instantly went from one that was developing at a rapid pace to one that is undergoing significant changes, unfortunately, in the direction of deterioration, so we will focus our research in this direction.

In modern global scientific research, the question of using digitization processes in the logistic service of economic and social processes is of great interest, including in the part of studying the sequence of processes and information from the delivery (movement) of products or services, that is, supply chains. Scientists from many economically developed countries of the world have been working on the study of these issues quite successfully since the middle of the last century. In Ukraine, well-known scientists such as Chukhrai N.I. [2], Hirna O.B. [2; 3], Krykavskyi Ye.V., Nakonechna T.V. [4], Oklander M.A. [5], Kachurovskyi V.Ie. [6], Medzhybovska N.A. [7] initiated the study of logistics processes in Ukraine. They laid the foundations for scientific research and practical implementation in social production. Among the Ukrainian scientists who are currently deepening scientific assets in this field, it is worth noting such researchers as Nehoda A.V. [8], Pashkevych M.S. [9], Pokhylchenko O.A. [10], Semchuk I.A. [11], Vostriakova V.I. [12], Huseva O.Iu. [13], Naumov M.S., Trutko [14], the scientific achievements of which are focused on the study of the implementation of digitization in modern supply chains. However, such significant changes in time give rise to new challenges, new scientific assets, which must be studied taking into account the new realities emerging in Ukraine and the world. The further combination in the innovative environment of digitalization processes and challenges arising as a result of the global economic upheaval is the scientific interest of many modern researchers, which requires an immediate solution. The issue of the impact of newly identified problems on global warming and greening of the public environment also requires additional study.

The purpose of our research is to study the main trends that have appeared recently in the economic activity of different countries in the direction of digital chain management and their use in various industries, to generalize these trends in order to attract innovative ideas in the use of such supply chains in logistics in modern and future conditions of digitalization of the economy, taking into account the needs of areas specific to Ukraine, such as environmentalization, green economy, etc., taking into account new challenges occurring in the modern world: the consequences of the global pandemic of COVID-19 and military actions in Ukraine, which also change the economic, logistical, political, social conditions of existence of the world community.

2. Innovative environment as a basis for the formation of supply chains

The development of scientific and technical progress (and in some moments the scientific and technical revolution) and the digitalization of this process, which continues to change at a fairly fast pace in the world, the significant impact of innovations specifically on the process of information exchange are closely related to the modern development of the concept of supply chain management, because it is the information that dramatically affects procurement schedules and production plans, taking into account changes in market conditions at the final stages of the supply chain. These questions are key in the scientific research of a number of scientists of Ukraine and the world, in particular, they pay significant attention to them in their research Girna O.B. [3], Medzhibovska N.A. [7], Pokhilchenko O.A. [10], Yakovleva M. [15].

We will remind that supply chains are a key concept in logistics, the simplest definition of this term is: «supply chains» is a sequence of processes and information that deliver products or services from suppliers, through production and distribution directly to the consumer [16]. If the sequence of processes has been studied almost perfectly for decades, then the sequence of information in supply chains has not been studied in sufficient detail and, as of today, it is not possible to study it due to constant changes in the information content in the chains themselves, both internal and external. Separately, we will highlight the concept of technological innovation, which is a peculiar form of information technology implementation, which enables enterprises to efficiently and quickly exchange the information they need, which ultimately led to the emergence of their own concept in supply chain management.

As we noted above, the study of logistics and the logistics system in Ukraine, both at the theoretical and practical level, has been going on for a long time, as an example, we can cite the monograph of M.A. Oklander, published in 2004, which studies the issues of solving the scientific problem of development theoretical and practical provisions for the formation of logistics mechanisms for the adaptation of enterprises to the external environment; the state of scientific opinion on issues of logistics theory is considered; the essence of the logistic approach is determined. The author proposed the principles and structure of the logistics system

of the enterprise; the relationship between logistics and marketing is shown, the foundations of the theory of macro-marketing support for the operation of logistics systems of enterprises are developed, the concept of the country's marketing system is proven, and the universal nature of the logistics methodology is proven [5].

In the conditions of globalization and the rapid expansion of markets for the sale of goods and technologies, the appearance of new goods (for example, information), innovation processes determine for enterprises to a large extent the competitiveness of such supply chains, therefore, the creation of an innovative environment that would help the enterprise to activate its activities in the direction of innovation and continuation of the life cycle of innovations itself, encourages such an enterprise to create new products of its activity: produce more new goods, provide more new services, etc. And although there is quite a lot of research into the innovation environment in both foreign and Ukrainian literature, such environments are mainly studied separately from the state, region, or enterprise, but in the supply chains that unite individual components of these objects, the level of research into the innovation environment in the inevitable conditions of digitization is, in our opinion, still insufficient.

Based on the classical innovation theory of Y. Shumpetera [17], the innovation environment should be understood as a set of systems, which is the fundamental core that forms innovation activity, in a broader sense, it can be defined as a combination of external and internal environments in the innovation process. If it is accepted as a condition that macro- and micro-environments can be included in the composition of the external environment, then, in turn, it is possible to refer to the micro-environment such components of its management as: innovative infrastructure (which serves the innovation process), administrative component, market of innovative investments (capital), the market of innovations (innovations). By following the connections between these individual components, it is possible to trace the elements of supply chains in their composition (as part of the innovation environment), although there is almost no clear manifestation here.

However, a clearer relationship of supply chains can be traced with the innovation environment, because the totality of enterprises that have a certain innovative activity are also supply chains, so it can be absolutely

definitely stated that supply chains are part of the innovation environment of enterprises.

It is known that one of those who initiated the research of the innovative environment is M. Castells, who defined it as a specific set of production and management relations based on a social organization that generally shares a work culture and instrumental goals aimed at generating new knowledge, new processes and new products. The specificity of the innovation environment is determined by its ability to generate synergy, that is, the added value is not derived from the cumulative effect of elements, but from their interaction [18].

In modern studies, the synergistic effect is also used as one of the main principles of the supply chain management concept for the formation of an innovative environment, because the improvement of the efficiency of the entire supply chain of enterprises directly depends on strengthening the focus of enterprises on the overall result and strengthening the interaction of enterprises among themselves, especially, under the condition of using processes developed in a digitized environment.

In the process of forming the innovative environment of enterprises, several stages are used, which become basic for the formation of actual supply chains.

The first of these stages is a classic one – data collection directly in the process of integrating the innovative environment of the enterprise with other participants of the supply chain.

Strategy development is the stage at which the direction of integration of the innovative environment of the economy with other participants of the supply chain is determined. In the process of such integration, it is possible to form the components of cooperation between participating enterprises in the form of, for example, writing down general concepts and principles of corporate relations in the field of innovative cooperation, creating innovative projects or innovations common to all or a separate group of enterprises, projects on the free exchange of information between chain participants.

Consumer loyalty management – the third stage – its task is to collect information about consumers of products or services, which are also a component of the supply chain of economic entities involving digitalization processes.

At the fourth stage, projects for the implementation of the developed measures are developed, their overall implementation is monitored, and the level of effectiveness is determined. It is important for this stage to receive feedback from supply chain participants about the effectiveness of the proposed measures and the level of satisfaction of all supply chain participants with the results of joint activities.

Having defined the relationships of supply chains and the innovation environment, we will determine the place and method of using supply chains in the modern economy, based on the fact that the modern economy is informationally and innovatively inextricably linked with the digitalization of all its processes.

Significant and important trends that will determine the development of logistics and supply chains in the near future (out of the specified 10), according to the scientists of the Cerasis company [10], are Directing to «digital supply chains» and Increasing requests regarding the «environmental» of products and the image of companies regarding «sustainable development».

The explanation to them has the following meaning:

Without digital technologies, supply chains have no future. Therefore, the requirement is for top managers to focus on building teams aimed at identifying the best ways to use the powerful potential of digital technologies in their supply chains. The tendency to increase investment in innovation will be observed. For example, in a recent survey, 94% cited «technology competency» as a key factor when considering outsourcing supply chain processes, including the use of third-party logistics (3PL) providers. The push for the use of digital technologies also provides the development of e-commerce, which is expected to grow over the next seven years, reaching more than $100 billion [10].

Reducing waste and increasing efficiency throughout the supply chain is one of the main demands of the future. From a supply chain logistical perspective, this equates to better monitoring and compliance with lead times, fuel usage, environmental impact and more.

Having chosen these trends, we believe that only the implementation of digital supply chains will contribute to the implementation of the trend of increasing requests for «environmental» products and the image of companies for «sustainable development», because the solution of these two issues are almost the main ones for the world community today.

Let's consider the issues we have identified with modern (in some cases promising) tools and mechanisms of work of virtual digital areas. New directions of the digital industry, and therefore the implementation of digital supply chains, can be considered: co-working centers, or co-working space; cross-platform with digital industry; digital hubs-studios, digital supply chains, etc. The principle of solving such issues can be based, for example, on the already known Internet of Things platform, where digital supply chains are already used quite successfully.

In the table 2.1 some tools of digital transformation of the business model of supply chains are classified and presented, which can also be applied for forecasting in supply chains in the new digitalization conditions.

Table 2.1

Tools for the digital transformation of the business model of supply chains

Networking	Digital Data	Automation	Digital Customer Access
Smart factory	Demand forecasting	Cars with autopilot	E-commerce
Platforms	Database routing	The process of intellectualization	Digitization of customer relations
Pure digital production	Predictive maintenance	Drones	Social networks
Cloud technologies	Internet of things	Robotization	Mobile Internet
Broadband Internet	Big data	Additive manufacturing	Appendices
Sensor technologies	Smart clothes		Information and entertainment system
Remote service			

Source: formed by the authors according to [19]

The application of the tools and mechanisms we have defined in the development of the process of using supply chains in a global dimension will allow to reduce, first of all, the initial capital costs for the deployment of the necessary digital infrastructure, because the process of its formation is almost the same all over the world, it requires the development and then the use of the same methods, methods, knowledge, and thanks to the

implementation of «cloud» technologies and software-defined architecture, these costs are significantly reduced.

Studying the impact of digitalization on the development of processes in the world, on the improvement of supply chains, we came to the opinion that today's Ukraine should take a direct part in this process and contribute to the development of these changes. Having a large number of domestically trained IT specialists working both in Ukraine and around the world (we also understand that their basic basic knowledge is almost the same, moreover, they are based on one or two schools that were started 30 years ago 40 years ago), using such a «collective mind», we propose to create a global network of IT-Ukrainian specialists for the implementation of basic, first of all, business ideas and the attraction of monetary income, possibly first in the digital hub «Ukraine and IT-Ukrainians», and then to support their state.

IT Ukrainians have been working outside of Ukraine for quite a few years, but in the last 7-10 years more and more of them are returning to Ukraine to live and work, so they can not only supply IT solutions to other countries, but also deepen the implementation of the digital economy. and its main processes that form the basis of digitization in Ukraine. It should be not only «production», but also «consumption» of IT products in one's country, and the use of these products in the real economy, that is, the application of such research in supply chains both within Ukraine and beyond. This is especially relevant today, when the country and its economy, having not recovered from the COVID-19 pandemic, being in a state of hostilities, have a great need to move large groups of internal and external migrants, military equipment, equipment, and humanitarian aid around its territory. The routes of such movements are often changed due to destroyed railway tracks, bridges, roads, and sometimes for the purpose of conspiracy of such transports.

We offer a quick implementation of this idea, because it is important for Ukraine today also because the so-called third wave of globalization, which is called inclusive, means that thanks to the development of the digital economy, and precisely the processes of digitization in it, small and medium-sized businesses have received an inaccessible earlier, the opportunity to become global, to join supply chains and the world economy, especially the European one. If the first wave of globalization in the

19th and early 20th centuries was controlled by large states (mainly their rulers), the second by transnational corporations, then the third wave will take place thanks to individual, first of all, small companies, and therefore it is beyond the power and expediency of each of them develop digital supply chains, they are already developed and should be used by such companies, and IT specialists should help them in this [20].

Ukraine is forced and «doomed» to take advantage of such an opportunity, because the conditions in which it finds itself today are extremely favorable precisely for the beginning of development according to such a scenario and do not at all contribute to the rapid recovery of development according to the classic scenario: the rapid recovery of industry, transport and even agriculture as a component A agro-industrial complex is not possible without the formation of supply chains according to the new digital scenario. This direction of the development of the modern economy is gaining extreme importance when the world economy emerges from another wave of the global economic crisis, which (as predicted by the world's leading economists and predicted by the most influential universities) occurred in 2019-2020. At the moment, the crisis, exacerbated by the viral infection, remains intense, and although the moment of its end is still unknown, the fact is clear that it will end sooner or later and the new challenges of the economy will have to be solved precisely by using the latest digital supply chains, including those defined by us.

In the global community, there are various options for proposals to solve the issues we have raised, in particular, the DHL company [21], being a leader in the field of logistics, structurally invests in researching trends and developing solutions. To ensure collaboration, the company brings together customers, research and academic institutions, industry partners and logistics experts in business units. Using the extremely large capabilities of such a company will make it possible to solve many issues facing global logistics enterprises. However, there are a number of both theoretical and practical issues that have either not yet been studied or are not included in the list of tasks of such companies. And with the rest, the cost of the services of such companies is quite high and often beyond the power of companies participating in logistics chains that are much smaller in size or that are engaged in a different field of activity. Such enterprises include farms within one country, region, etc.

We can cite examples of proposed options for solving logistics service issues by DHL, which will serve as a model for enterprises of the economic sector in Ukraine. For example, the construction of a 250,000 square foot distribution center in the US with environmentally responsible design elements and efficient operating systems; development of an innovative solution for the organization of on-board food and waste disposal for the British Airlines; development of a project in the retail sector to reduce carbon emissions during transport operations between suppliers and distribution centers in the UK [21], there are a number of other companies that are also developing special projects or using already prepared ones, so the examples we have given confirm our opinion that that the use of digitization processes in all these developments is obvious and undeniable.

By the same data, it is possible to see and explore the main key trends and innovations that can help navigate the changes coming to global economic research due to digitalization, because during the first two decades of this millennium, the development of technology, new business models and drastic changes in behavior customers have changed the logistics industry, as well as most other industries. In the interactive version of Logistics Trend Radar (Figure 2.1), it is possible to follow these trends and innovations [21].

Figure 2.1. Logistics Trend radar [21]

Using Figure 2.1, we determine that these trends have a technological direction and a socio-business direction. Depending on the research goal, we can consider a combination of these trends in the development of the global logistics market to study its individual components. The key directions of development are defined as: globalization of the activities of client companies; merger and acquisition of individual logistics companies, which leads to their consolidation; the sharp increase in the role of digitization and information technology in both logistics and supply chain management; focusing on the provision of ready-made and complex logical solutions in supply chains, moving away from the provision of specialized services; inter- and multimodal transportation will have intensive development; increasing market share of 3PL providers. In the Table 2.2 we will group according to the data of Figure 2.1 logistic trends according to their levels and directions.

Table 2.2

Logistics world trend radar

Influence	Social and business trends	Technological trends
higher	Super network logistics; New generation security; Sustainable logistics; Logistics markets; The future of work; Omnichannel logistics	Self-driving vehicles; Artificial Intelligence; Robotics and automation; Cloud and AR; Internet of things; Big data analytics
average	Smart containerization; Multisourcing; Servitization; Sharing economy; Mass personalization; Rethinking packaging; Fresh chain	Quantum computing; Digital twins; 3D printing; Unmanned aerial vehicles; Blockchain; Wireless network of the new generation
lower	Space logistics; Silver economy	Augmented and virtual reality; Bionic boost

Source: formed by the authors according to [21]

Let's consider what role the world's largest 3PL providers play in digitalization of logistics and transformation of supply chains (their rating is given in Table 2.3). These are world giants, whose revenue in the specified field of activity is the largest.

Table 2.3

Ranking of the world's ten largest 3PL providers

№	Company	Country (headquarters)	2018 revenue, USD million	2019 revenue, USD million	Changes for the year, %
1	DHL Logistics	Germany	29 162	30 775	5,50
2	Kuehne & Nagel	Switzerland	20 283	22 572	11,30
3	DB Schenker Logistics	Germany	16 028	17 783	10,90
4	C.H. Robinson Worldwide	USA	11 705	13 503	15,40
5	DSV	Denmark	10 063	11 355	12,80
6	XPO Logistics	USA	9 408	10 352	10,00
7	UPS Supply Chain Solutions	USA	6 793	7 981	17,50
8	CEVA Logistics	Netherlands	6 646	6 994	5,20
9	Expeditors International	USA	6 097	6 920	13,50
10	J.B. Hunt	USA	6 181	6 828	10,50

Source: formed by the authors according to [22]

The conducted studies show that the largest digital 3PL providers use quite a variety of digital technologies: 52.79% – Blockchain technologies; 51.30% – artificial intelligence; 44.61% – robotics; 42.01% – unmanned vehicles; 24.91% – drones; 24.90% – other technologies; 6.69% – technologies that are not included in the above [22].

We would like to note that, as indicated in [23], digitalization does not exclude the possibility of using a system approach to logistics. The relevance of the system approach in the logical sphere of the enterprise is determined by the following features:

– development of the logistics system of the enterprise taking into account the principles of the system approach with the selection of the main elements of the system;

– marketing orientation of the company's logistics system (satisfying market needs);

– determining the optimal level of customer service;

– interconnection and interdependence of logistics processes;

– dependence of the logistics system of the enterprise on the environment;

– compliance of the logistics system with the company's development strategy;

– information support and support of the logistics system;

– analysis, assessment and accounting of logistics costs and determining the efficiency of the logistics system.

The review of the leading analytical, consulting and IT companies and their systematic analysis led to the identification and systematization of trends both in the direction of the general vectors of the development of logistics and supply chain management in the world, and in the direction of their digitization. 10 trends can be identified for the logistics of the future [10]:

1. Consumers will demand faster delivery times and a variety of last-mile delivery options.

2. Companies localize the construction of warehouse facilities.

3. Improvement of transport infrastructure by the state will stimulate the development of digital logistics.

4. The boundaries defining the peak shopping season are «blurring», which requires logistics to be more flexible due to predicative analytics and the latest forecasting.

5. Companies will seek to improve their relationships with 3PL providers.

6. Variable logistics operations will become the standard.

7. NEW Waves technologies (blockchain, Internet of Things, artificial intelligence, virtual reality, machine learning) require a reassessment of logistics strategy.

8. Specialized stores will remain relevant.

9. Customers will demand more and more transparency of logistics operations.

10. The openness of logistics to new digital technologies will grow.

Having identified 10 trends in the development of logistics for the future, the world's leading companies did not prioritize such global modern challenges as global warming and the accompanying deterioration of the environment in this list. After conducting our own observations, we suggest adding to these trends the following, which, in our opinion, are also of primary importance:

– the development of logistics as a field of activity that contributes to the elimination of environmental threats. (In this case, fairly stable greening trends of all areas of economic activity should be formed and, first of all,

ecological logistics with appropriate supply chains should be formed. Then reducing resource costs and reducing polluting emissions will be a real goal of greening logistics).

– increasing inquiries regarding the «environmental» nature of products and the image of companies regarding «sustainable development» – a trend that is already being developed by scientists [10], but it is not given due attention among the 10 recommended; because reducing waste and increasing efficiency throughout the supply chain is one of the main requirements of the future. From a supply chain logistical perspective, this equates to better monitoring and compliance with lead times, fuel usage, environmental impact and more.

3. Supply chains in the post- COVID-19 and war period

In the process of evolution, even in its short period, the essence of some concepts can change significantly, and logistics was no exception (both from a scientific and from a practical interpretation). One of the variants of the origin of the term «logistics», as evidenced by the data [16], claims that «logistics» has been known since the time of the Roman Empire, where employees who were engaged in the distribution of food products were called «logistics» or «logistics». Logistics became a science thanks to the development of military affairs. Thus, the Byzantine emperor Leo VI (865–912) believed that the task of logistics is to pay tribute to the army, properly supply it with weapons and military property, take care of its needs in a timely manner and fully prepare each act of a military campaign accordingly, make a correct analysis terrain in view of the movement of the enemy's army and forces and, in accordance with these functions, to manage and manage, that is, to manage the movement and distribution of one's own armed forces.

1,000 years later, during the Second World War, the principles of logistics began to be successfully put into practice, when in the USA, the USSR and other countries, work was carried out to study the properties of material flow management operations. During these years, research was carried out related to the problems of military and typical front-line supply, mathematical methods and models were developed, which eventually got the name «operations research», thanks to which it was possible to organize a constant supply of weapons for the American army [16].

Unfortunately, Ukraine did not have to wait a thousand years and, if we equate the fight against the COVID-19 pandemic and its consequences with military operations and combine it with the destruction and losses during Russia's full-scale aggression against Ukraine, we can say that the initial importance and role of logistics in its understanding, it fully corresponds to the modern state and it is called to perform its originally assigned functions at a qualitatively new level.

Today, logistics acquires the meaning of the concept of effective management, its role increasingly acquires the characteristics of a continuous flow of anything (goods, materials, information, etc.), which turns into a competitive, perfect, efficient supply chain. At the same time, first the outbreak of COVID-19, and from February 2022 the beginning of military operations on the territory of Ukraine suffered losses, or were completely destroyed, supply chains that had been established for years, primarily global ones. The industry of logistics links in the chain of goods mobility has also suffered: problems with the workforce, ambiguity and uncertainty in rules and regulations, changes in infrastructure, etc.

Primarily, supply chains for companies with manufacturing facilities in China were disrupted, causing exports of manufactured goods and imports of agricultural goods to and from China to decline significantly. According to World Bank reports, in China between January and February 2020, freight volumes fell below 15% compared to 2019 levels, before showing signs of recovery in March [24].

The future situation in Ukraine and the countries connected with it depends on the well-founded research of scientists in today's post-war and military conditions regarding scientifically based and practical recommendations in logistics supply chains. The situation that caused crisis phenomena in the social, economic, technical, humanitarian, informational environment in which companies are forced to work today added high risks to international supply chains, where Ukrainian companies were a part of them. Disrupted and damaged supply chains are the cause of many problems that need to be addressed quickly, otherwise they will harm the economic recovery process. Scientists of Ukraine and the world need to very quickly determine the new conditions for the functioning of the logistics chains of Ukrainian enterprises under conditions of war based on the generalization of foreign experience in the optimization of logistics chains, for example,

by identifying and classifying potential and existing risks. The experience that can be used in the development of these recommendations can be that obtained in the practical activities of enterprises and logistics firms during the period of the COVID-19 pandemic around the world.

The changes taking place in Ukraine and the world in the modern dimension are so significant that they require an urgent, deep and detailed analysis of the emerging situation. The sudden occurrence of unpredictable events in the economic environment and the decline in the pace of development of modern processes under the influence of the global economy of COVID-19 and the military aggression of Russia on the territory of Ukraine are the most significant factors that caused sharp changes in political, social, economic, and most profoundly – logistical relations in all over the world, regardless of the location of countries on the globe. From drastic economic (decrease in the production of almost all types of products, reorientation of production capacities to goods that are currently needed in much larger quantities, closure of certain cities, borders, enterprises, etc.), political (against the background of social discontent, the population of many countries demand a change of government), demographic, migration, etc. changes in the world have created problems that have never had to be faced, let alone solved so quickly. A large part of these unresolved issues have to be solved with the help of logistical changes: redirecting the flow of goods, providing storage facilities, ensuring large migration flows, etc.

First of all, COVID-19 and its impact on the economic situation in the world caused a sharp push for the development of both digital technologies and the revision of conceptual approaches to the structure of the formation and creation of more perfect supply chains. The latest digital technologies, which have not yet been introduced in some industries, have become a mandatory basic component of the new era of the development of modern generation supply chains.

Research and Markets predicts that the next-generation logistics market will reach $125 billion by 2030, driven by supply chain software, robotics and automation, autonomous vehicles, and counterfeit goods tracking [24].

Logistics chains, which have been fixed and worked for decades, have to be changed, redirect the flow of goods in other directions, etc. The tool for solving many problems is the complete and comprehensive digitization of all processes, and not partial, as it was 2-3 years ago.

The challenges of the pandemic and military actions for logistics activities and supply chain management in new real-time conditions will be considered in more detail in further studies, here we will only define them as those that have already interfered with the logistics processes of the country and the world.

In particular, it is:

– exit from the market of weak players;
– growing demand for the «groupage» service;
– implementation of outsourcing;
– contactless courier delivery;
– development of «autopilot» deliveries;
– implementation of «digital doubles»;
– personnel policy regarding remote working conditions;
– compliance with sanitary standards by logistics companies;
– transfer of logistics measures to the online format [3];
– establishment of a sharp increase in road and bus transportation due to a reduction in air, rail, river, and sea transportation;
– refusal to cooperate with the aggressor country;
– formation of financial and food aid collection centers;
– establishment of delivery of humanitarian aid within the country and from abroad;
– provision of free logistics services to Ukrainians;
– provision of volunteer work;
– staffing and technical support of IT specialists to work in conditions of digitization of supply chains and cyber security.

The constantly changing business and economic environment requires adequate transformations of all spheres of the country's socio-economic life, including adaptation of the labor market to changes caused by pandemic restrictions and military actions on the territory of Ukraine. The practical experience of Ukrainian logistics operators shows that the management of supply chains under martial law is an incredibly difficult process due to the destruction of a significant amount of transport and storage infrastructure, blockade and overloading of available transport routes, fuel shortages, direct threat to human life, etc. The pandemic, war and other adverse obstacles to physical presence at the workplace have caused drastic changes in the nature of work. The notion of where work can be done (at the workplace) is likely

to continue its shift from physical to virtual environments as organizations increasingly implement remote work tools. Accordingly, they are forced to rebuild the concept of working with personnel and strategic guidelines for the development of human capital [25].

At the same time as negative manifestations, pandemic restrictions and military actions stimulated positive trends related to the acceleration of the processes of digitalization of business and the development of socio-economic communications. According to OpenDataBot, IT is the only business sector that grew in 2022 and in the first five months provided $3.2 billion in export revenue, which is 27% more than the same period in 2021 [26]. We drew attention above, and this is confirmed by international experts, that Ukraine has a fairly high level of digitalization, and this is a good platform for the restoration of its economy and rapid innovative development. Because of this, digital and information and communication skills are a criterion for employers working in farms and government institutions, this has a direct relation to the logistics industry and supply chains.

Understanding the importance of logistics for the timely provision of military operations and production, the growth in demand for logistics services and the increasing role of supply chain management in global and regional markets cause increased interest in the formation and development of logistics personnel, the set of general and professional competencies of logistics specialists and the optimal ratio between them, the study of the impact of the global pandemic on the content and working conditions, the peculiarities of the transition of office and operational workers to remote work and increased requirements for ensuring labor safety and civil protection. In scientific discussions and business forums, the growth of the role of «soft» skills of employees in comparison with «hard» ones is noted, although, in our opinion, it is problematic to draw a clear line between these skills in the conditions of the active introduction of digital technologies, since they are closely interconnected, especially in those areas where business is based on active socio-economic communications [25].

In Figure 3.1. we will show the trends that have emerged in the development of logistics services in the new crisis conditions that have arisen in the last 3 years and we will highlight the factors of their influence on the change of critical competencies of logistics specialists. Among the main trends of the logistics services market, the increase in visibility,

transparency and security of global supply chains is singled out, which, accordingly, changes logistics processes and stimulates the use of modern information and communication technologies for monitoring and tracking goods movement in real time, as well as adjusting management decisions regarding the selection suppliers, routes and delivery methods.

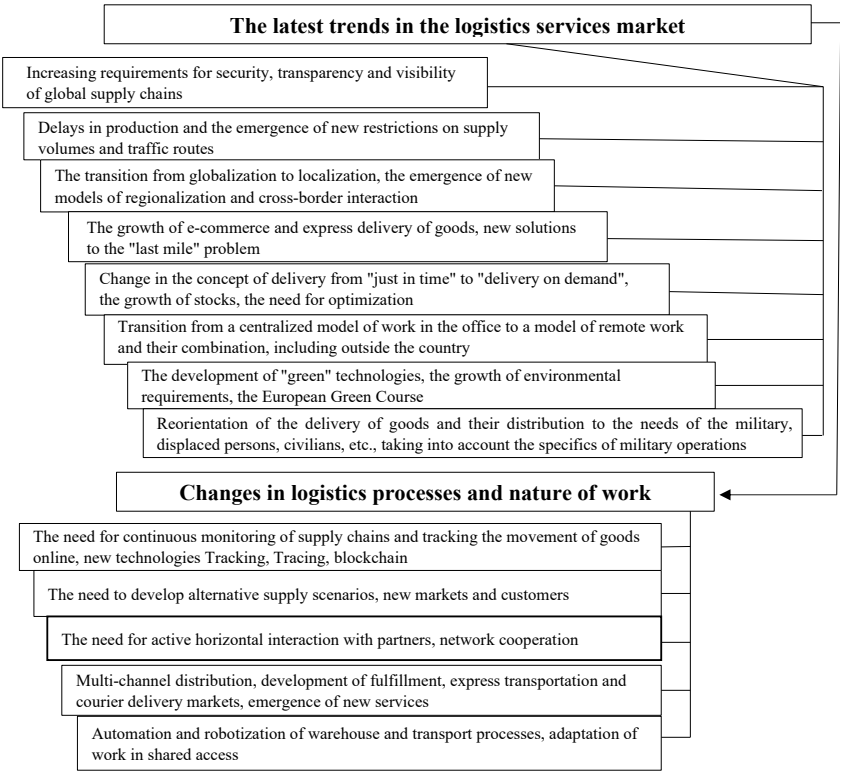

Figure 3.1. The latest trends of factors affecting the logistics services market and changes in logistics processes

Source: created by the authors according to [25]

As manufacturing and trading companies move from centralized, linear supply models to decentralized networks (which are more flexible and

efficient), they need to detect failures in a timely manner and make fast, fact-based decisions. Geoinformation and intelligent systems use artificial intelligence to analyze large volumes of information and promptly respond to supply chain signals, identifying vulnerable places, minimizing the negative consequences of probable or real failures [25].

In modern conditions, all these trends must be redirected in the direction of the military situation, therefore even greater difficulties arise in the conditions of operation of logistics centers and chains of supply of goods, services, information, etc.

The same issues apply to changes in logistics processes and new working conditions for employees. One of the difficult conditions for the modern fulfillment of the duties of any of the personnel of both supply chains and logistics centers is the lack of the latest technologies (latest software, equipment, means of combating cybercrime, etc.) and insufficient professional training of employees to work with these technologies.

A detailed study of such challenges will make it possible to somewhat improve the social, economic, and logistical situation that has occurred, and to manage these processes.

4. Digital economy as a prerequisite for creating modern supply chains

Globalization processes taking place in the world are already irreversible, besides, they have their own significant advantages, transformations in the modern economy are also irreversible, when a new one comes to replace the classical one, which ruled the world for hundreds of years, to the laws of which all mankind has adapted, with rules and laws unknown to the main players of the digital economy. The combination of these "elements" leads to significant changes in the social system, which must be taken into account, adapted to them and used for the benefit of the modern economy.

Classical economic theory, which was based on laws, postulates and categories that were considered indisputable, as it seemed even 30-40 years ago, receives new directions of development, which should come to theoretical economics under the influence of the processes that globalization brings with it. The impact of the modern digital economy on globalization processes is obvious, but there is a need to substantiate it theoretically and give a logical scientific explanation to these phenomena.

The same irreversible changes are taking place in the concepts and categories used by these economies. At the same time, there is a group of definitions that play only a theoretical role in the formation of concepts and categories, and there are definitions that, in addition to the theoretical, also have a practical load, that is, how the category is used in industrial use. Logistics and one of its main components "supply chain" belong to such theoretical and production concepts.

It is clear that over the past decades, the opinion that the influence of information technologies on the global economy leads to changes in the economy itself has been increasingly appearing in economic publications, and Ukrainian scientists are actively discussing this Voinarenko M.P. [27], Huseva O.Iu. [13], Kraus N.M., Kraus K.M. [28], Liashenko V.I. [29], Malyk I.P. [30], Norets N.K. [3], Skorobohata L.V. [27], Stankevych A.A. [31], as well as scientists-economists of various countries of the world, in particular D. Tapskott [32], T. Levit [33], Dzh. Stihlits [34], Erik S. Rainert [35], U. Khus, R. Atkinson, C. Kholroid T. Mesenburh etc. However, the issues of the direct impact of changes in the economy towards digitization on globalization transformations in the world are not discussed enough, or at the level of informatization and implementation of IT technologies. Not enough attention is paid to the theoretical justification of these interconnected processes, especially to those new areas that are either little or not studied at all, such as the impact of digitalization processes on supply chain management.

The task of this stage of the research is to study the impact of digitalization of the economy in certain sectors (economies) and countries on the globalization processes taking place in society, the world economy, taking into account changes in theoretical classical economics and changes in modern categories and concepts.

Economists in Ukraine and the world, studying the opinion on the development of the digital economy, perceive differently not only the digital economy itself as a science, but also the term "digital economy", therefore there are various misunderstandings about the implementation of the very idea "into life", because different interpretations of the definition cause different vectors of application of the idea, and this, in turn, affects the perception of the "digital economy" in the economic community as a science and the directions of its development in the world, that is, the globalization processes in general.

As can be seen from our previous studies [36], even 10-20 years ago, the concept of digital economy did not dominate the theoretical studies of both Ukrainian and foreign scientists. Among the large number of terms that described the emergence of new business areas in the economy with the help of Internet technologies, the Internet itself, etc., we will highlight a few:

– «electronic economy» (this term was first used by Nicholas Negroponte back in 1995), over time it acquired a new name «digital economy», as of today the category «electronic economy» has two components: Internet economy (an environment for conducting electronic business) and «digital economy» – where production, exchange, distribution and consumption of «electronic goods» takes place, and calculations are carried out using electronic money [27];

– in the same 1995, the term «digital economy» began to be used, in particular, one of the world's leading scientists, Don (Donald) Tapscott, gave the following definition for it: digital economy – an economy based on the dominant use of digital technologies [27]; and the famous American programmer Nicholas Negroponte formulated its concept: in a concise form, it sounds like «the transition from the processing of atoms to the processing of bits».

– neoeconomy (the origin and rapid development of which falls on 2000-2015); it is interpreted as a post-industrial stage of the development of the economic system, the fundamental theoretical constructions of which are the information, innovation, digital, network economy. The demarcation of these concepts is based on the selection of key areas and resources of economic development [27];

– in Ukraine and the world, different names of new types of economic concepts are distinguished: «information society», «knowledge economy», «network economy», calling them synonyms [30], or such that one can be components of another, etc.

Today, in scientific economic literature, the term «digital economy» is becoming more and more dominant, and it is increasingly found in economic literature as a key category in defining the modern economic state.

A large cohort of today's scientists believes that the digital economy, although it has entered «everyday use», has not provided itself with a sufficient number of concepts, categories, not to mention the new economic laws by which humanity must live in the next 50-100 years.

In the technological aspect, the digital economy is defined by four trends: mobile technologies, business analytics, cloud computing and social media; globally – social networks such as Facebook, YouTube, Twitter, LinkedIn, Instagram, etc. In recent years, such Internet-dependent markets as: tourism, games and e-sports, media and banking services have also received active development.

The gradual digitization of the mass segment is changing the nature of online consumption. In the segment of tourism and travel, the transition from on-line booking of tickets to full selection, comparison and payment of tours is striking. In the segment of banking services, personal offices replace standing in line at the bank counter for the purpose of paying utility bills, topping up the phone, paying for loans, etc [31].

Some scientists, studying the current state of digitalization and the prospects for its development in the future, focus on studying issues aimed at developing tools and mechanisms for virtual digital coworking centers, cross-platforms with digital industry, digital hubs-studios, hubs-associations and hackathons, with the aim of creating a digital reality in Ukraine based on this knowledge. After all, virtualization allows you to reduce the amount of initial capital costs for the deployment of the necessary digital infrastructure by using «cloud» technologies and software-defined architecture (from the English «software-defined architecture») [28].

Guseva O.Yu. also gives its definition: the digital economy is an economic activity characterized by network consciousness and the interconnection of virtual technologies. In other words, it is the economy of virtual worlds [13].

Economic shifts and processes taking place in the modern world are changing so quickly that it is difficult to describe them by the categories of classical economics. Violent changes in political relations between countries lead to the same changes in the world economy. This is most noticeably observed in such processes as digitization and globalization, which are too closely related to each other and have approximately the same changes in the vectors of their development.

An important factor in the development of both the world economy and the economy of individual countries, economic processes taking place in society is the impact of the digital economy on globalization. Among the main areas of research of the world's leading scientists are the influence of the digital economy on the labor market and the forms of its organization

(U. Hus), the connection between innovative activity and the digital economy (R. Atkinson), the connection of globalization and digitalization (C. Holroyd). It is on the latter that we want to focus our observations, because the main problems of humanity and the economy are related to the issues of unemployment, poverty, and most importantly – environmental problems. After all, only here on a planetary scale can the application of knowledge and the use of real assets of the digital economy solve, or at least reduce, the negative consequences.

There are different approaches to defining the information (digital) economy. One of the generally accepted definitions was proposed back in 2001 by T. Mesenbourg and is still used in the statistical bodies of economically developed countries. According to this approach, it is proposed to include three main components in the composition of the information (digital) economy:

– e-business infrastructure (equipment, software, telecommunications, networks, human capital, etc.);

– electronic business (implementation of any business processes via the Internet);

– electronic commerce (sale or purchase of goods and services on the Internet) [29].

From the standpoint of classical economic theory, such a choice of components cannot be considered random. The processes of «production, distribution, exchange and consumption» substantiated more than 150 years ago by the classics of political economy are clearly consistent and correlated with the components of the digital economy. Electronic business determines the digitization of production. E-commerce, reconciling the interests of the seller and the buyer, leads to the digitalization of exchange and distribution. At the same time, the consumption of digital products is expanding. Mass purchase and use of mobile applications for smartphones running Android or iOS is an example of digital consumption. If we consider the digitalization process from the point of view of dividing the economy into three sectors (primary – agriculture and mining, secondary – industrial production, tertiary – services), the fundamental difference is not so much an increase in the share of the tertiary sector or the emergence and expansion of a new (digital economy), and the radical transformation of all three already existing sectors. Given the modern technological capabilities and trends in

their development, the classic division between the specified sectors may disappear. For example, it is already technologically possible remotely in smart mode (on-line) e-business infrastructure, e-business, e-commerce to cultivate agricultural land, harvest crops, produce industrial products, perform medical operations and provide various services. Therefore, the digitization is not of individual sectors of the economy, but of the entire economic system [29].

The term «globalization» in modern economic literature is not only the most frequently used, but also the most debated; confirming this, we will present some definitions of it by the classics of world literature. T. Levit introduced it to science for the first time, defining it as «the phenomenon of the merging of markets for individual products produced by large multinational corporations» [33]. Another well-known Nobel laureate scientist J. Stiglitz believed that this is the removal of barriers to free trade and closer integration of national economies [34]. The World Bank and the IMF interpret the concept of globalization as the rapid integration of rich and poor countries in terms of trade and investment, which increases the convergence of markets thanks to the cross-border movement of goods, capital, information, technology and people [35]. It should be noted that the same International Monetary Fund does not focus on the issues of the different impact of globalization on the development of rich and poor countries, for the most part – the rich continue to get richer, the poor become poorer, but many scientists deal with such issues so that, using the latest knowledge, methods and instruments of influence on the economy of the world and individual countries, to strive for equalization of the economic development of these individual countries.

Let us consider the above-mentioned issues of modern (in some cases promising) tools and working mechanisms of virtual digital directions, in the format of their connection with global economic processes. New directions of the digital industry can be considered:

– coworking centers, or coworking space, which is a relatively new workspace for representatives of modern creative and innovative professions, in particular, Internet workers, which include a large number of different fields: programming, design, etc. Coworking in the broadest sense is an approach to organizing the work of people with different occupations in a common space; in a narrow one – a similar space, a collective office

[37]. Another definition is a form of self-organization, communities and free people of any profession, status, united in one space to do some work [38]. Coworking contributes to the development of a startup culture (a culture that is built either on the basis of new innovative ideas or technologies that have just appeared), providing not only all the necessary infrastructure for the development of a new project and creating a certain creative atmosphere, but also forming a creative community, members which can be included in a new startup project [39].

– cross-platform with digital industry. Cross-platform – a virtual platform for training and conducting WEB-conferences (webinars), it is a new service for training, which is being developed using digital technologies. In Ukraine, for example, the cross-platform WiZiQ is used for implementation in education based on indicators of availability, cost, and expanded capabilities. This service enables subject teachers to create virtual classes and teach students in real time online. Teachers also get the opportunity to create profiles and fill them with materials related to their activities, and also create a small library of books and presentations [40] to increase the potential for joint activities and the initiation of joint projects not only within the micro- or meso-region, but also in the country as a whole, or several countries. Such cross-platforms facilitate the exchange of experience and establishment of cooperation; within the framework of extracurricular education, they provide an opportunity to improve the level of communication between public organizations and government representatives, etc.;

– digital hubs-studios. Under the hub (from the English «hub» – «center», «hub» (the central part of the rotating part of some mechanism), in the general sense, we see the node of any network).

A digital hub can be considered a digital system that includes its own digital projects and its own digital infrastructure and provides other structures with information and consulting, scientific and technical, scientific and technological, infrastructure and production services for solving the problems of technology transfer and commercialization of innovative objects. of digital activity, a digital hub is a system of interconnected Internet projects, the core of which is a hub studio (starting from a hub-school-studio and ending with a hub-cluster-studio), which concentrates the solution of global, central problems, projects etc. and involves interested parties in their development and implementation.

The principle of solving such a question can be based, for example, on the already known Internet of Things platform.

The Internet of Things (IoT) platform is not just a smart home or a smart enterprise, experts predict that in the near future billions of devices will solve a wide variety of tasks in various fields. So they already solve many tasks.

Rising investment in the revolutionary IoT technology, which shows promising potential for supply chains, is expected to drive the market. According to a survey by Kenco Group, 56% of supply chain executives said they planned to invest in sensors and the Internet of Things in 2020, and 40% of respondents indicated that they intend to invest in blockchain technology. By 2025, the market for IoT solutions, particularly for forklifts, will reach USD 47.6 billion with a CAGR of 12.0% between 2020 and 2025 [41].

Key IoT service providers are deploying a new generation of robots that are safe, intelligent, and able to work side-by-side with humans. For example, Amazon, one of the most significant players in the field of e-commerce, uses several types of robots in its warehouses (palletizers, robots and actuators) that perform various operations, such as picking up heavy objects and preparing goods for sending to a storage location. There are currently 200,000 robots in Amazon warehouses. In 2020, the company invested $40 million in a new 350,000-square-foot robotics innovation center in Massachusetts, which is expected to drive the market in the future [41].

Researchers from Oxford at one time identified 5 main attributes that form an ideal innovation hub [42], we believe that its main properties also correspond to a digital hub:

1. Community. Hubs usually emphasize that they only serve to meet and unite the Internet community, and that without this community, they would be worthless.

2. Self-organization and adaptability. Hubs should not function top-down; they always arise from the "grassroots" initiative of innovators and entrepreneurs. Hub managers usually see themselves less as leaders and more as mediators. While donors and sponsors are generally needed to fund the hubs, they are seen as more supportive, not allowed to impose an agenda that does not meet the needs identified by the community.

3. Not to innovate, but to help innovators. Hubs are not creators or implementers of innovations (projects, startups, applications, etc.). Hubs can be more or less picky and hard-nosed about the artists they support, but at the end of the day, entrepreneurs are seen as the ones making a real difference in the world.

4. Heterogeneous knowledge. Perhaps the most interesting property of hubs is that they seek to gather like-minded people, but at the same time unite people with different life experiences and knowledge. The underlying idea is that startups require complementary components (eg, creative product design and funding), and that innovation inherently relies on new and unusual combinations of existing knowledge.

5. Local outposts of a higher purpose. Another interesting aspect of hubs is that they emphasize adaptation to local conditions, but at the same time tend to define themselves as part of a global movement. In fact, coworking is increasingly seen as a global movement, and it has begun to provide ideas and templates for the design of hubs (which often turn out to be similar in different parts of the world) [42].

In today's globalized world, it is important to find a center of gravity – a «hub», some «central point» of the researched object, the economy or infrastructure of the industry, the state, around which everything revolves. The creation of such a hub as a center for the production of competitive products will serve as the basis for grouping around it a zone of infrastructure service organizations and their further integration into the cluster. The hub can be considered as the beginning, the starting point of the birth of the future network structure – a cluster, and the emergence of a new form of organization of interaction between economic subjects of a certain region. The most innovatively active company, research organization or higher education institution can become an initial center, a hub that unites with a certain number of carefully selected business partners who are interdependent on the technological chain and interested in economic symbiosis:

– hub-association – taking into account the definition of the concept of «association» (an association is a contractual association created for the purpose of permanent coordination of the economic activities of the united enterprises by centralizing one or more production and management functions, developing specialization and cooperation in production, the

organization of joint productions based on the pooling of financial and material resources by the participants to meet mainly the economic needs of the participants of the association. The statute of the association must state that it is a business association. The association does not have the right to interfere in the economic activities of the enterprises – members of the association. According to the decision of the participants, the association may be authorized to represent their interests in relations with authorities, other enterprises and organizations [43]), let's assume that this is the same contractual association of key players of the Internet community for the coordination of joint actions with one hub-center, which coordinates the activities of primarily product-producing firms, selling firms, and firms providing infrastructure services. The key difference of the hub-association should be non-interference in the activities of participating firms, in particular, in financial activities. The creation of such hubs-associations can be useful for entities of any size during the formation of the "rules of the game" during the formation of superstructures of various directions in the process of all-consuming globalization.

– a hackathon is (English hackathon, from hack (see хакер) and marathon) – a forum during which various specialists in the field of software development intensively and cohesively work together to solve a problem or create a new application or service. Hackathons usually last from one day to a week. Some hackathons are designed for educational or social purposes, but often the goal of a hackathon is to create a complete piece of software. Each hackathon focuses on certain areas, for example, programming languages, operating systems, applications, application programming interface (API) [16]. In this sense, this term, we believe, best meets the demand of the digital economy.

Our proposed interpretation of the defined terms will make it possible to use them, if not in this version, then at least in a way that is close to a certain direction of research.

Therefore, the use of the tools and mechanisms we have defined in the development of virtualization on a global scale will allow to reduce, first of all, the initial capital costs for the deployment of the necessary digital infrastructure, because the process of its formation is almost the same all over the world, it requires the development and then the use of the same methods, methods, knowledge, and thanks to the implementation of «cloud»

technologies and software-defined architecture, these costs are significantly reduced. At the same time, it is advisable to use such a wide range of them in the digitalization of logistics processes and their main link – supply chains.

According to the results of forecast data from Research and Markets, the cloud supply chain management market will amount to 8.61 billion US dollars in 2026, which is almost 2 times more than in 2020 (4.58 billion US dollars) [24]. The accelerated adoption of cloud-based business operations worldwide will lead to the digitization of the logistics industry, as it is able to withstand the amplitude of volatility and constant speed, as well as facilitate a faster response to disruptions in supply chains. Businesses and organizations are actively moving towards restructuring their supply chains into a digital supply chain that integrates the physical flows of products and services and provides affordable, efficient, secure, infinitely scalable solutions that can be easily integrated into existing systems [41].

As noted [14], for society, digitization means a new paradigm of the nation's development, based on the daily use of digital technologies in all spheres, which ensures the efficiency of data exchange and quick access to information. The result of these transformations was the formation of the sharing economy (sharing economy), which is a combination of horizontal business connections and an information platform that allows integration of millions of sellers and buyers. In such an economy, the behavior of subjects fundamentally changes: they treat each other as equals.

The sharing economy is completely based on the use of new supply chains, different from the classic ones, which requires the introduction of mandatory digitalization into the process of their application.

Of course, the actors of the sharing economy can be large corporations, but they take lessons on an equal basis with others, do not have any significant advantages and cannot abuse their market power. The essence of the sharing economy is the most efficient use of resources, which is achieved through a mutually beneficial exchange or provision of unnecessary (temporary or permanent) goods for the use of other subjects. For a significant number of people, this behavior only allows them to compensate for their own costs, but for others, it turns into a business model of the firm, which involves the deliberate acquisition of a certain resource for further provision to interested persons [14], and the use of this resource is conditioned by the use of supply chains of its elements.

In today's global world, the sharing economy is estimated at several tens of billions of dollars, and it is predicted that in just a few years its volume will amount to 335 billion dollars [15]. The elements of the sharing economy appeared almost half a century ago, but only in the conditions of digitalization did it begin to acquire such significant importance.

The popularity of the sharing model is explained by its many advantages, among which the following can be highlighted: saving money and time (costs for renting goods are much lower than for buying them), financial benefit (receiving income from providing things that would otherwise not be used), increased sales volume, additional opportunities (you can get much more things for temporary use than you can buy), more cohesive communities (the presence of ratings and reviews make community members honest, and interpersonal cooperation strengthens trust) [14].

The factors that hold back the development of the sharing economy are related to the inability of the state to regulate the activities of its participants. The most problematic is taxation due to the lack of effective mechanisms for tracking cash flows. A significant disadvantage of the sharing economy is the lack of opportunities to ensure proper working conditions, guarantee the appropriate quality of goods or services, and formalize official employment, since the platforms position themselves as intermediaries and shift responsibility to the direct producer or service provider. The issue of the possibility of providing certain types of services by sharing companies remains debatable, which forces the authorities of certain states to limit the activities of sharing services. Finally, it is extremely difficult to keep statistical records of the size of the sharing economy [14].

In general, several types of consumption can be distinguished, which create prerequisites for the establishment of a sharing economy. One of them is crowdfunding, which consists in the investment of funds by the consumer in the creation of new products. Another type is personalized consumption, when the end consumer adjusts products to their personal needs. Then there is the demand for handicrafts, which is growing rapidly as a result of dissatisfaction with mass-produced products and the desire to obtain unique goods or services. The next type is joint consumption, which involves the purchase of goods for use by a group of people. And the last is the joint creation of value, when the consumer's contribution to

the development of the final product becomes so serious that the boundary between him and the producer disappears [14].

It is clear that all the described processes occurring in the sharing economy apply new models of consumer behavior, and the entire process of such use is based on digital supply chains, because when using classical chains, these processes will occur very slowly, or will not occur at all.

However, in order to use the ways of studying supply chain management processes in conditions of digitization, for example, in Ukrainian enterprises today, there are a number of obstacles that must be overcome as quickly as possible to achieve the set goal. Unfortunately, according to official statistics, Ukraine is not yet ready to implement such recommendations due to the lack of elementary tools: information and communication technologies.

It is also obvious that increasing the efficiency of the digitalization of economic processes also involves the use of information and communication technologies at Ukrainian enterprises (according to their main indicators), because the implementation of logistics operations necessarily requires a clear observance of processes, including technological ones, in all links of supply chains.

It is also clear that Ukrainian enterprises are forced to rapidly introduce digital technologies into their business processes. This means not only the installation of modern equipment and software, but also fundamental changes in management approaches. The process of digital transformation touched all areas of business: from how the company acquires and retains new customers, to how the management imagines and manages the company's reputation on the Internet [44].

Data on the use of information and communication technologies at domestic enterprises according to their main indicators are given in the table. 4.1, they indicate that not all Ukrainian enterprises have access to the Internet, which significantly complicates their work, especially when joining the supply chains of goods and services.

According to the source [45], access to more modern office software, application software for accounting, finance, application software for managing information about customers/buyers in Ukraine is significantly improving, which will enable time savings as a result of the digitization of these same business processes in the process of using logistics supply chains. It is important to note that the share of the number of enterprises

using robotics in the total number of enterprises in 2021 was 2.9%, of which industrial robots – 1.2%, service robots – 2.1% [45]. Obviously, this is much less than what is needed for the industry, less than in some other countries, but it is a positive direction for the development of information and communication technologies at Ukrainian enterprises in ensuring the performance of work in supply chains.

Table 4.1

The level of use of information and communication technologies at Ukrainian enterprises in 2018-2021

№	Indicators of the use of information and communication technologies	2018	2019	2021*
1.	The number of enterprises that have access to the Internet (units)	43303	43785	44508
1.1.	The number of enterprises that have access to the Internet (in % of the total number of enterprises)	88,0	86,4	86,6
2.	Number of employed workers who have access to the Internet (persons)	1064745	1090035	1133069
2.2.	The number of employed employees who have access to the Internet (in % of the total number of employed employees of enterprises)	27,1	28,4	28,0
3.	The share of the number of enterprises that use fixed access to the Internet in the total number of enterprises, %	62,1	60,9	61,8
4.	Share of the number of enterprises that have a website in the total number of enterprises, %	35,6	35,2	35,3
5.	The share of the number of enterprises that purchase cloud computing services in the total number of enterprises, %	9,8	10,3	10,2
6.	The share of the number of enterprises that have hired specialists in the field of ICT in the total number of enterprises, %	22,3	21,6	21,7

* Collection and calculation of data for 2020 was not carried out in accordance with the updated approved statistical methodology, which takes into account the requirements of Commission Regulation (EU) No. 2019/1910 of 07.11.2019 regarding the use of ICT and electronic commerce. According to the aforementioned regulation, the collection, formation and publication of individual indicators regarding the use of ICT at enterprises must be carried out during the peak period in which the corresponding state statistical observation was carried out

Source: compiled by the authors based on [45]

The use of modern information technologies to improve the logistics processes of the enterprise ensures the timeliness and detail of information for the purpose of managing flow processes in complex economic systems, provides an opportunity for in-depth analysis, modeling of processes and forecasting prospects for their development. It is information technologies that make it possible to rationally manage all types of resources of the enterprise, since the key factor in the success of the management system is the adoption of the correct and timely management decision regarding the concentration of resources. The data generated using information technologies allow to regulate the amount of resources at the right time and in the right place to meet the production, administrative and other needs of the enterprise [46].

Based on this, we note that general computerization as a modern trend is directly related to all types of activities, including economic and logistical, thanks to which, through information systems, information is presented in a convenient form, where each specific user can independently accelerate or to facilitate any operations on its introduction, processing, generalization, which will make it possible to improve the visibility and comprehensibility of available documentation in the process management of complex economic systems. Such an opportunity to use the automation of logistics processes for the enterprise will make it possible to reduce the time spent by workers in performing their functional duties, reduce the cost of financial resources and provide the management apparatus with the necessary information in a timely manner, and consumers with the supply of appropriate quality products. As a result, enterprises performing production and sales activities have the opportunity to choose for their activities the software that will provide an opportunity to form effective logistics processes and manage them. Thanks to the same choice, there is an opportunity for enterprises to participate in the management of the supply processes of their products in the chains of their supply to the consumer, monitoring the entire process and, if necessary, intervening in it. Therefore, the research and study of the features and problematic aspects of the use of information technologies in the improvement of internal logistics processes have a scientific and practical interest of both technology developers and consumers of these technologies at all stages of product production and delivery to the final consumer.

Therefore, among the problems related to increasing the use of digitalization processes in supply chains, it is necessary to solve, first of all, the issue of the organization of ensuring such work at the enterprise; provision of qualified personnel who will perform such work, and in some cases training of such personnel; provision of technological equipment (first of all, modern digital technologies) and direct implementation of digital channels of interaction both in the internal economic environment, and communication with the external logistics environment, where such chains will work.

5. Development and use of IT solutions in logistics and supply chains

Modern changes taking place in the economy of Ukraine and the world once again confirm the timeliness and importance of using IT technologies in industries related to the agro-industrial complex and logistics in it. Concentrating attention on the main problems of the economy: the COVID-19 pandemic and Russia's military aggression on the territory of Ukraine and on the consequences that these problems have brought and will bring to society in the near future and in the future, scientists and practitioners (except for highly specialized fields to which this problem belongs) do not focus on problems that are not so obvious, but they exist and will have their consequences later. For example, global warming, damage from environmental pollution, extinction or special destruction of animals, which are considered diseases that are either unknown or such that humanity has not yet learned to fight them.

In an effort to solve the most urgent problems, IT and logistics specialists come to the fore, looking for methods and ways to eliminate these problems.

It is on the basis of knowledge of the latest technologies and management of logistics processes, and their main component – supply chains – that the main amount of modern scientific research is based on.

World logistics centers monitor research areas, including in the IT field, and determine trends in the development of such areas. So, for example, analysts of the specialized publication Logistyczny.com [47] based on the results of 2021 compiled a list of the most popular directions in which logistics companies digitized their activities last year. Experts note that the pandemic and restrictions that have been in effect for a long time in the economy of many countries had a significant impact on the introduction of new IT solutions. If earlier online accounting was the most popular, now

attention has shifted to automated supply chain management and the Internet of Things. The elimination of paper document circulation was only the first step in this large-scale transformation process, notes Mariusz Slavek, vice president of the board of Infinite IT Solutions. After all, thanks to online documents, it was possible to achieve a significant saving of resources and speed up the cargo registration process. The main advantage of electronic document management systems is faster processing of documents and reduction of archiving costs. Such systems can be integrated with any ERP and support various file formats.

The next direction of analytics is called online accounting of human resources. In this case, we are talking about effective planning and accounting of employees' working hours, as well as calculating their wages. The result of the introduction of new IT solutions was the possibility of more flexible use of existing personnel and a better distribution of responsibilities between people [47].

The third segment of digitization concerns the introduction of electronic signatures and the use of biometric data for access to various systems, documentation at the time of receiving and issuing goods and in other cases. This is also related to the development of electronic accounting, but the use of new generation systems and devices allows us to talk about this area as a separate and very important one. It is enough that the signature can be put on the tablet so as not to send every driver or forwarder to some office in the office. Only thanks to this solution, the warehouse will release cars from the ramp faster. Finally, the fourth and fifth most popular segments of digitization are numerous developments for the development of online trade and e-commerce in the B2B sphere. This is generally a very broad topic, experts note. It is impossible to reveal it within one publication. However, everyone is convinced that there is an almost inexhaustible development potential here [47].

It is clear that in 2022, the most popular solutions in the IT field will be logistics developments, which were completely, partially or tangentially destroyed by military actions on the territory of Ukraine as a result of the hostile aggression of Russia. In modern logistics, moving cargo around the world requires urgent scientific, special, professional developments, which will be based only on the methods and tools offered by means of digitalization.

The opinion of M.O. Homeniuk is quite interesting [48], where the author in the course of his research analyzed the integration of digitization processes in the work of logistics enterprises, rather interestingly outlined the role and significance of network and cloud information storage systems for logistics enterprises, etc. Our attention was drawn to the opinion of the author that the system of digitalization in the field of logistics can be presented in the form of a community formed on the basis of the use of digital platforms and their applications, by developers, providers and users of logistics services, agents who have experience in the field of logistics and possess competencies acquired through the use of digital information technologies. The author's opinion deserves attention and further study, which explains that the cloud information system in logistics is the result of adding additional digital objects to the physical reality, which are usually displayed as auxiliary information, resulting in a mixed reality.

We agree and support the opinion of the author [48] that, taking into account the rapid development of digital technologies and the integration of digitalization processes, further intensive implementation of them into industry practice is expected in order to improve the quality of service services, competitiveness and customer orientation of logistics enterprises, and the introduction of digitalization processes into the field of logistics, and in our opinion, should be based on information support of integrated development systems in the direction of improvement of production, trade and economic processes of the movement of commodity and material flows in the «chain of value creation».

The applied tasks of digitization are the reduction of time, labor, and financial costs associated with the search for data, as well as IT applications for the formation of optimal business partnership schemes based on effective modeling of horizontal production-economic and trade-economic relations between various organizations – participants in the logistics process. The implementation of digital technologies will increase the effectiveness of the interaction of participants in the logistics process, will create organizational and technological conditions not only for concluding mutually beneficial contracts for transportation, but also for automating the processes of controlling the movement of vehicles and operations, improving the quality of the work of employees, simplifying the procedure

for drawing up documents for making calculations with all participants logistics chain, etc. [48].

Taking into account the above and other important trends of the implementation of digitization processes into economic and logistic activities and taking into account their similarity in many areas of research, it is advisable to carry out further scientific and practical developments in this area taking into account and in close cooperation with the study and implementation of practical foreign experience of using innovative digital technologies for the work of enterprises in both the economic and logistics spheres.

IT technologies have long been widespread in various sectors of the economy, including transport and logistics. The implementation of IT solutions in the logistics of companies allows you to gain tangible advantages over competitors on the market. First, all processes are accelerated (response to emerging problems, 24/7 customer support, etc.), coordination and control of all logistics functions is improved. IT solutions help solve customer problems, create long-term business relationships, improve the image of logistics companies, etc., which is relevant in today's turbulent environment.

The questions and identified problems have long been successfully investigated by both Ukrainian and foreign researchers, but the new challenges of modern times give rise to new questions in their solution and remain relevant. Among the issues that concern the scientific community is the implementation and operation of innovative IT solutions in the development of logistics. So, in their research, Chukurna O.R., Nitsenko V.S., Mykhailova M.V., Odinokov R.D. etc. [49; 50; 51; 52; 53] considered the main directions of innovative development of transport logistics and warehouse logistics based on e-commerce solutions, the latter being one of the main features of the 4th industrial revolution; Witkowski W., Huk K. and Perzyńska A. [54] suggest implementing IT innovations in logistics; Douglas M. [55; 56; 57] summarizes that IT solutions in logistics are most in demand to ensure effective integration of manufacturers and customers; Duster R. [58] claims that the higher the cost of implementing IT solutions, the less noticeable they are; Nitsenko V. and others. [59] suggest using methods of economic-mathematical modeling and analysis of various factors in order to reduce the level of riskiness of IT solutions;

Wiggins J.P. [60] recommends developing a transport management system (TMS), which will help solve many problems within the company and provide competitive advantages, etc.

In connection with the rapid development of the market of IT solutions, additional research is needed on the trends in the development, implementation and operation of logistics companies, as already mentioned above, these should be both the leading companies of the world and individual countries, as well as smaller ones, but those that deal with solutions modern urgent tasks of social development. Hence the purpose of the study: to study the main trends in the development of IT solutions in the innovation market for logistics needs and their effectiveness in logistics companies.

Acquaintance with the work of the world's leading companies made it possible to determine the main directions of their work and the technologies they use. In particular, IT companies (360data, Alpega, C3 Solutions, CyberLogitec, Data2Logistics, etc.) focus their attention on solving both individual and complex tasks (load planning, optimization, procurement, speed and rates, reverse logistics, routing and planning, transport management system, etc.) of logistics enterprises. It enables the implementation and operation of IT solutions in the areas of supply chain, logistics, vertical specialization, cost base, third party logistics and add-on solutions. Today, the issue of improving the efficiency of logistics processes requires active actions from the management of companies, so their competitiveness depends, first of all, on the timeliness of responding to global trends and challenges in the field of IT technologies. IT developers, as research has shown, focus most of their attention on solving the problems of transport service providers – more than 90% of all respondents focus on them. It should also be noted that more than 80% of IT solutions in vertical specialization are concentrated in the field of agriculture in terms of production, transportation and wholesale trade. Despite these advances, less than 40% of companies use technology to monitor supply chain performance. In connection with the increasing complexity of sending goods by shippers to customers, many companies turn to the help of so-called 3PLs (third-party logistics). Studies have shown that more than 80% of all shippers use 3PLs, which helps them improve customer service. Maersk, Schneider, LufthansaCargo, SAS CargoGroup A/S, AsstrA and others can be singled

out among the companies that implement and use the achievements of IT technologies in their logistics activities. The specified IT solutions gave such companies the opportunity to more effectively control and coordinate the delivery of goods, integrate the interfaces of the consignor and the client into a single network, optimize the work of their own divisions, reduce logistics costs, etc. This is also confirmed by the fact that more than 60% of all senior managers who are involved in the work of transport at enterprises felt significant positive changes of global transformations [61].

The structure and dynamic shifts of international trade relations are never stable, constant data, their changes occur both qualitatively and quantitatively, and the structural structure of world trade exerts an extraordinary influence on international transportation itself. The choice of supply chain strategy, in this dimension, is significantly influenced by uneven fluctuations of dynamic shifts in transnational transportation, which depend on a number of significant and non-significant factors, such as: seasonality, development of certain industries in countries, prices, political, economic, social conditions, military conflicts and military operations, such as in Ukraine from February 2022. The global coverage of countries by the network of international trade, regardless of the level of development of these countries, economic status, etc., caused their dependence on international transportation and international trade itself. On the other hand, all international trade, international transportation (regardless of its mode: aviation, railway, road transport, sea and river vessels, pipeline, etc.) are also completely dependent on influencing factors. The most significant influence: scientific and technical innovations; deepened international division of labor; creation and operation of transnational corporations. Studies of these processes reveal a growing trend towards a sharp increase in road transport across continents, causing significant changes in established supply chains. An important factor in the development and transformation of the logistics system is also the increased demand for freight transportation due to the rapid development of world trade. Changes in the social environment, primarily the pandemic, led to new challenges in this network: for example, logistics firms that were engaged in the transportation of, for example, branded clothing, had to change their direction due to lack of demand, a sharp increase in the supply of drugs around the world caused a different logistics orientation. Supply chains had to quickly reorient themselves to

the new realities of the times. Based on this, we see that the globalization of production, based on planning, supply, trade, has led to distributed trade and the development of transport networks at a new organizational level. Quick resolution of newly created issues in the global dimension is possible only with the use of new IT solutions.

According to the authors [61], a survey conducted in 2019 showed that 93% of all IT solution developers provide services to transport service providers, compared to 87% in 2018 [55]. An interesting fact is that vertical specialization in logistics services is most common in agriculture, accounting for 85% of all IT solutions for production, transportation and wholesale trade. The lowest level of IT solutions is observed in energy (37%) and related industries – oil and gas (45%) [56]. At the same time, the Business Continuity Institute's Supply Chain Resilience Report 2019 shows that only 37% of companies use technology to monitor supply chain performance [58]. That is, fruitful work is needed to improve the company's image, reduce financial costs, etc.

IT solutions in logistics involve the implementation of various services, such as: supply chain solutions (demand management, product life cycle management, etc.), logistics solutions (inventory management, optimization, procurement, etc.), vertical specialization (by type of economy). activity), platform (Cloud, SaaS, etc.); base cost (free (price based on other variables), transactional (subscription), etc.); maintenance of other types of economic activity (production, retail trade, etc.) and additional (accompanying) solutions (Blockchain, asset management, big data management, etc.).

In [59; 60; 62; 63] the information support of cargo delivery as a subsystem of logistics is considered. This component can significantly reduce the cost of basic logistics services, which has been studied specifying the main factors of influence.

The implementation of TMS is proposed for use to ensure the implementation of the order through the customer system and to implement their solution in the most efficient and cost-effective way [64].

The process of sending goods from shippers to customers is constantly becoming more complicated, so many of the former turn to 3PLs (third-party logistics). More than four out of five shippers who responded to the 2018 Penn State and Penske Logistics 3PLs survey noted that 3PLs help them improve customer service [65].

Table 5.1

Characteristics of companies providing IT solutions for logistics needs

Name of the company	Platform	Pricing	Industries Served	Supply Chain Solutions	Logistics Solutions	Additional Solutions
360data	Cloud / SaaS / Hosted	Transactional	E-Commerce, Manufacturing, Wholesale, Services / Government, Transportation	-	TMS	EDI Integration
Alpega	Cloud / SaaS / Hosted	Transactional	Manufacturing, Retail, Wholesale	-	Load Planning, Optimization, Procurement, Rate & Bid, Reverse Logistics, Routing & Scheduling, TMS	Capacity, Order Management, Process Improvement, Strategic Sourcing
C3 Solutions	Cloud / SaaS / Hosted	Transactional	E-Commerce, Manufacturing, Retail, Wholesale, Transportation	Dock Scheduling and Yard Mana-gementSystems	Dock Capacity Planning, Routing & Scheduling	IoT / IIoT
CyberLogitec	Cloud/ SaaS/ Hosted	Transactional	Manufacturing, Services/ Government, Transportation	GTM, Security	Optimization, Routing & Scheduling, WMS, Wireless / Mobile	Freight Forwarding, Liner Management, Terminal OperatingSystem
Data2Logistic	Cloud / SaaS / Hosted	Transactional, Seat/User	E-Commerce, Manufacturing, Retail, Wholesale,Services / Government	Modeling / Forecasting / Predictive Analytics, Security, Supply Chain Control Tower	Auditing / Claims /Freight Payment, Procurement, Rate & Bid	Big Data Management, Process Improvement, StrategicSourcing

TMS – Transportation Management System; GTM – Global Trade Management

Source: based on [66]

Among the companies that are the flagships of the implementation and use of logistics IT solutions are well-known global companies: Maersk, Schneider, Lufthansa Cargo, SAS Cargo Group A/S, AsstrA and others (Table 5.2).

Table 5.2

Practical aspects of innovative IT solutions in logistics companies

Name of the company	Implemented IT solutions
Maersk	Updated the existing virtual assistant Captain Peter and provided efficient remote container management in the combined fleet of Maersk and Hamburg Süd. The implemented solution makes it individual client.
Lufthansa Cargo	Increased sales through the digital channel. To achieve a higher result, the company used the mechanism of dynamic spot prices, ie immediate booking. The company plans to implementthis IT solution in all its branches by the end of 2020.
Schneider	Launched a new tool that makes it possible to book cargo in real time for third-party operators. The implemented IT solution allowed to reduce the time spent on logistics operations, streamline all processes and eliminate time-consuming operations to establish a connection between the operator and the broker.
SAS Cargo Group A/S	A new e-booking tool has been launched from Scandinavian Airlines' cargo and logistics department. The customer using the Internet can use direct tariffs, which is provided by the available bandwidth on WebCargo. The latter is a platform for automating tariff management and back-office operations.
AsstrA	Implemented the following IT solutions: EDI solutions for integration with customers. Providing information about shipment to the client; Track & Trace solution is designed to track cargo in real time by using GPS navigation or the company's mobile application. AsstrA constantly automates and improves its processes based on OTM (Oracle Transportation Management). CRM and ECM solutions are being actively developed. In addition, management decisions, analysis of work is carried out through a customized Business intelligence-system, abbreviated BI, in which all information is consolidated.

Source: based on [67; 68]

The implementation of IT solutions provides increased efficiency of individual units and the company as a whole. There is a gradual decrease in administrative, operating and other costs within the enterprise [69].

A recent study by Forbes Insights [70], which surveyed more than 400 senior executives directly involved in transportation, found that 35% did not experience significant changes in global transformation, while 65% did the opposite.

Thus, IT technologies provide a high degree of efficiency of implemented innovative solutions in logistics companies, namely:

– reduction of time for information processing, integration of separate client bases and bases of shippers;

– high degree of automation of logistics processes;

– control and coordination of all logistics operations (chains) within the enterprise;

– reduction of administrative, operational and other costs;

– optimization, coordination and control of cargo movement, etc.

6. Conclusions

Sudden and rapid changes in the world economy over the last 3-5 years lead to new challenges in studying them and finding ways out of difficult situations created as a result of these changes. An essential solution tool is the widespread introduction of digitization methods, which are already used to a certain extent in the world economy, and within its limits – the rapid transition of logistics (as part of its supply chains) to the use of the latest information technologies: a set of methods and technical means of collection, organization, preservation, processing, transmission and presentation of information using computers and computer communications.

Modern studies of the relationships between the concepts of «innovation environment» and «supply chain», the process of forming a favorable innovation environment in supply chains in the modern conditions of digitalization of the economy is a conceptually important concept that should be aimed at creating mechanisms for increasing innovation activity as a focal organization, and others participants in its chain as a result of the synergistic effect between them, which, in turn, will lead to the strengthening of the competitiveness of organizations,

products, services due to the increase in the speed of development and introduction of new products and technologies; delivery of these types of products to the consumer.

Among the main global trends in the future development of logistics and supply chains, there were none that would meet the demands of modern changes in the economy in connection with global climate changes and the impact on the ecological state of the environment of various emissions, ranging from environmental pollution to specific emissions from car engines, which is an essential factor in the further existence of society. Research shows that the main tool that will significantly help to solve the mentioned problems is the digitalization of supply chains in all sectors of the world economy, and IT specialists, including Ukrainians, can provide great help here by joining their specialized community.

In the process of further research, it is advisable to continue the study of issues in the direction of search and implementation in logistics, and in it in supply chains of tools, which are, first of all, tools of digitalization of the economy, which will contribute to the improvement of meeting the needs of society, taking into account the urgent challenges of today: global warming and environmental pollution.

The term «logistics» and the science of logistics were defined as those that began to be used due to the development of military affairs, in all subsequent military companies, logistics receives accelerated development. Nowadays, military operations are also taking place on the territory of Ukraine, which is logistically connected to a large number of countries in the world, so it is obvious that the development of logistics connections and supply chains in the conditions created today in rather crisis conditions should be accelerated.

Modern changes in the economy are accelerating due to new challenges in society, first of all, these are the consequences of the COVID-19 pandemic and Russia's armed aggression in Ukraine, which in a short period of time disrupted logistical connections established over decades not only in certain regions, but also throughout the world, which also needs an immediate solution.

The world economy is developing at a fast pace, which means that this development has its consequences. The most important of them are the transition from the classical to the digital economy and its impact

on globalization processes caused by changes in the economy itself. Classical economics yields its postulates not only in practical (applied) economics, but also in theoretical ones. Laws, categories, concepts, tools are replaced by a new level that requires its own theoretical justification and understanding. We focused on new and emerging concepts such as digital co-working center, cross-platform with digital industry, digital hub studio, hub association, hackathon, Internet of things, which were defined or suggested for use, in our opinion, which are already used in the scientific literature.

IT technologies give a powerful impulse to the development of logistics. Currently, IT developers offer a wide range of solutions for logistics companies (supply chains, logistics solutions, vertical specialization, base cost, service of other economic activities, additional (related) solutions). It should be noted that the largest share (93%) of all IT solution developers are transport service providers. Among the owners of logistics companies, more than 60% do not use technology to control the productive efficiency of supply chains, which has a negative impact on their image and costs. At the same time, the experience of the world's leading companies (Maersk, Schneider, Lufthansa Cargo, SAS Cargo Group A/S, AsstrA) shows the high effectiveness of the implemented IT solutions in logistics. As a result, there is a significant reduction in total costs of enterprises, increasing the degree of control, coordination and preservation of goods and logistics processes, the integration of interfaces of transportation carriers and customers into a single network.

Our research allows us to assert: global changes in the modern economy have a significant impact on globalization processes in the world, therefore Ukraine, having the unique potential of IT specialists, should use it for the benefit of the development of both the global and its economy, especially in the period of a new wave of economic crisis. which, according to the predictions of the leading scientists of the world, will be quite long and will have a global character, and for Ukraine, the question of its large-scale reconstruction also arises, which cannot be solved without a detailed study of the impact and application in practical implementation of digitalization methods and tools in the economy as a whole and changes in supply chains.

References:

1. Zhelikhovska M. (2022) Modeliuvannia lohistychnoi systemy pidpryiemstva v umovakh tsyfrovoi ekonomiky [Modeling of the logistics system of the enterprise in the conditions of the digital economy]. *Visnyk Khmelnytskoho natsionalnoho universytetu. Seriia: Ekonomichni nauky – Bulletin of the Khmelnytskyi National University. Series: Economic Sciences]*, no. 4, pp. 50–55. DOI: https://doi.org/10.31891/2307-5740-2022-308-4-8. (in Ukrainian)

2. Chukhraj N. I., Hirna O. B. (2007) *Formuvannia lantsiuha postavok: pytannia teorii ta praktyky* [Formation of supply chains: issues of theory and practice]. L'viv: «Intelekt-Zakhid». (in Ukrainian)

3. Hirna O. B. (2020) Lohistyka i lantsiuh postavok: vyklyky pandemii COVID-19 [Logistics and Supply Chain: Challenges of the COVID-19 Pandemic]. *Prychornomorski ekonomichni studii – Black Sea Economic Studies,* no. 55 (1), pp. 87–93. DOI: https://doi.org/10.32843/bses.55-14. (in Ukrainian)

4. Krykavs'kyj Ye. V., Nakonechna T. V. (2016) Vid kholodnoi lohistyky do lantsiuhiv kholodnykh postavok [From cold logistics to cold supply chains]. *Visnyk Natsionalnoho universytetu «Lvivska politekhnika». Seriia: «Lohistyka» – Bulletin of the Lviv Polytechnic National University. Series: «Logistics»,* no. 846, pp. 79–84. (in Ukrainian)

5. Oklander M. A. (2004) *Lohistychna systema pidpryiemstva: monohrafiia* [Logistics system of the enterprise: monograph]. Odesa: Astroprint. (in Ukrainian).

6. Kachurovs'kyj V. Ye. (2010) Informatsijna lohistyka [Information logistics]. *Visnyk Natsionalnoho universytetu «Lvivska politekhnika». Seriia: «Lohistyka» – Bulletin of the Lviv Polytechnic National University. Series: «Logistics»,* no. 690, pp. 53–58. (in Ukrainian)

7. Medzhybovs'ka N. (2011) Suchasni tendentsii upravlinnia lantsiuhamy postavok [Modern trends in supply chain management]. *Pratsi Odes'koho politekhnichnoho universytetu – Proceedings of the Odessa Polytechnic University,* vol. 1 (35), pp. 283–288. (in Ukrainian)

8. Nehoda A. V. (2019) Didzhytalizatsiia lohistychnykh protsesiv ta lantsiuhiv postachan [Digitization of logistics processes and supply chains]. *International relations. Part «Economic sciences»*, vol. 2, no. 20, pp. 99–101. (in Ukrainian)

9. Pashkevych M. S. (2015) Porivniannia lantsiuha postavok vyrobnychoho ta servisnoho pidpryiemstva [Comparison of supply chains of manufacturing and service enterprises]. *Biznes Inform – Business Inform,* no. 1, pp. 235–240. (in Ukrainian)

10. Pokhyl'chenko O. A. (2019) Trendy lohistyky ta Supply chain management v proektsii transformatsijnykh zmin Industry 4.0 [Trends in logistics and supply chain management in the Industry 4.0 transformative change project]. *Intelekt XXI – Intelligence XXI,* no. 3, pp. 149–154. Available at: http://www.intellect21.nuft.org.ua/journal/2019/2019_3/26.pdf (accessed January 2, 2023). (in Ukrainian)

11. Semchuk I. A. (2020) Doslidzhennia lantsiuhiv postachannia pry vzaiemodii sil's'kohospodars'kykh pidpryiemstv-vyrobnykiv biopalyva [Studies of supply chains in the interaction of agricultural enterprises producing biofuels].

Ahrosvit – Agroworld, no. 10, pp. 124–131. DOI: 10.32702/2306(6792.2020.10.124 (in Ukrainian)

12. Vostriakova V. I. (2015) Kontseptualna model analizu ahroprodovolchoho lantsiuha postachannia [Conceptual model of agro-food supply chain analysis]. *Visnyk ONU imeni I.I. Mechnykova – Bulletin of ONU named after I.I. Mechnikova,* vol. 20 (5), pp. 97–100. Available at: http://visnyk-onu.od.ua/journal/2015_20_5/22.pdf (accessed January 12, 2023). (in Ukrainian)

13. Husieva O. Yu. (2018) Napriamy realizatsii kontseptsii tsyfrovoi ekonomiky Ukrainy [Directions of realization of the concept of digital economy of Ukraine]. *Ekonomika. Menedzhment. Biznes – Economy. Management. Business,* no. 2 (24), pp. 97–102. (in Ukrainian)

14. Naumov M. S., Trutko A. O. (2022) Ekonomika spilnoho korystuvannia yak model povedinky v umovakh tsyfrovizatsii [Sharing economy as a model of behavior in digitalization conditions]. *Aktualni pytannia rozvytku svitovoi ekonomiky ta mizhnarodnoho spivrobitnytstva:* Materialy mizhnarodnoji nauko-vo-praktychnoji Internet-konferenciji*,* Kharkiv: KhNUMH im. O.M. Beketova. (in Ukrainian)

15. Yakovleva M. (2019) Podilytysia zi svitom: shcho daie ukraintsiam sherinhova ekonomika [Share with the world: what the sharing economy gives Ukrainians]. Available at: https://tyzhden.ua/Economics/229889 (accessed December 21, 2022). (in Ukrainian)

16. Vikipediia [Wikipedia]. Available at: https://uk.wikipedia.org/wiki/ (accessed December 21, 2022). (in Ukrainian)

17. Shumpeter B. A. (2011) *Teoriia ekonomichnoho rozvytku. Doslidzhennia prybutkiv, kapitalu, kredytu, vidsotka ta ekonomichnoho tsyklu.* [Theory of economic development. A study of earnings, capital, credit, interest, and the economic cycle]. Kyiv: Vydavnychyj dim «Kyievo-Mohylianska akademiia». (in Ukrainian)

18. Kastels M. (2000) *Informatsijna epokha: ekonomika, suspil'stvo i kul'tura* [Information age: economy, society and culture]. Moskva: HU VShU. (in Ukrainian)

19. Shalmo D., Christopher A. Williams, Luke Boardman. (2017) Digital ttansformation of bussines models – best practice, enablers and roadmap. *International Journal of Innovation Management,* vol. 21 (08), pp. 1–17. DOI: 10.1142/S136391961740014X. (in English)

20. Koliadenko S. V. (2020) Vplyv tsyfrovoi ekonomiky na hlobalizatsiiu [The impact of the digital economy on globalization]. *Ekonomika, finansy, menedzhment: aktual'ni pytannia nauky i praktyky – Economy, finances, management: topical issues of science and practical activity,* no. 2 (52), pp. 104–118. DOI: 10.37128/2411-4413-2020-2-5. (in Ukrainian)

21. DHL Ukraina. Insajty ta innovatsii. Lohistyka Trend radar. Available at: https://www.dhl.com/ua-en/home/insights-and-innovation.html (accessed December 28, 2022). (in English)

22. Materialy kompanii Armstrong & Associates, Inc. (A&A). Available at: https://www.3plogistics.com/about-armstrong-associates/ (accessed December 15, 2022). (in Ukrainian)

23. Suchasna kontseptsiia lohistyky [Modern concepts of logistics]. Available at: http://logistic-info.ua/sovremennaja-koncepcija.html (accessed December 15, 2022). (in Ukrainian)

24. Research and Markets. The Words Largest Market Reseach Store. Available at: https://bit.ly/3wUqaJn (accessed December 28, 2022). (in English)

25. Hryhorak M. Iu., Volovyk O. I., Tsapenko O. A. (2022) Transformatsiia profesiinykh kompetentnostei lohistiv pid vplyvom pandemichnykh i viiskovykh obmezhen ta yikh rozvytok v umovakh vidnovliuvalnoi ekonomiky [Transformation of professional competencies of logisticians under the influence of pandemic and military restrictions and their development in the conditions of a recovering economy]. *Visnyk ekonomichnoi nauky Ukrainy – Herald of economic science of Ukraine,* no. 1, pp. 153–160. DOI: https://doi.org/10.37405/1729-7206.2022.1(42).153-160. (in Ukrainian)

26. IT-posluhy – yedyna haluz biznesu, shcho zrosla u 2022 rotsi [IT services are the only business sector that grew in 2022]. Available at: https://itc.ua/ua/novini/it-industriyaukrayini-prinesla-3-2-mlrd-za-pershi-p-yat-misyatsiv-tseyedina-galuz-biznesu-shho-zrosla-u-2022-rotsi/ (accessed October 18, 2022). (in Ukrainian)

27. Voinarenko M. P., Skorobohata L. V. (2015) Merezhevi instrumenty kapitalizatsii informatsiino-intelektualnoho potentsialu ta innovatsii [Networking tools for capitalization of information and intellectual potential and innovation]. *Visnyk Khmelnytskoho natsionalnoho universytetu. Seriia: Ekonomichni nauky – Bulletin of the Khmelnytskyi National University. Series: Economic Sciences*, no. 3, pp. 18–24. (in Ukrainian)

28. Kraus N. M., Kraus K. M. (2018) Tsyfrovizatsiia v umovakh instytutsiinoi transformatsii ekonomiky: bakhovi skladovi ta instrumenty tsyfrovykh tekhnolohii. [Digitalization in the Conditions of Institutional Transformation of the Economy: Highlights and Instruments of Digital Technologies]. *Intelekt XXI – Intelligence XXI,* no. 1, pp. 211–214. (in Ukrainian)

29. Liashenko V. I., Vyshnevskyi O. S. (2018) *Tsyfrova modernizatsiia ekonomiky Ukrainy yak mozhlyvist proryvnoho rozvytku* [Digital modernization of the Ukrainian economy as an opportunity for breakthrough development]. NAN Ukrainy: In-t ekonomiky prom-sti. Kyiv. (in Ukrainian)

30. Malyk I. P. (2013) Tendentsii rozvytku informatsiinoi ekonomiky v Ukraini [Trends in Information Economy Development in Ukraine]. *Visnyk Skhidnoievropeiskoho universytetu ekonomiky i menedzhmentu – Bulletin of the East European University of Economics and Management,* no. 1 (14), pp. 25–34. (in Ukrainian)

31. Norets N. K., Stankevich A. A. (2017) Tsifrovaya ekonomika : sostoyanie i perspektivyi razvitiya *[Digital economy: state and development prospects]. Innovatsionnyie klasteryi v tsifrovoy ekonomike: teoriya i praktika:* trudyi nauchno-prakticheskoy konferentsii s mezhdunarodnyim uchastiem 17–22 maya. SPb.: Izd-vo Politehn. un-ta. (in Ukrainian)

32. Tapscott D. (1996) The Digital Economy. McGraw-Hill. (in English)

33. Levitt T. (1983) The globalozationof Markets. Harvard Businass Review. May-June 1983. (in English)

34. Joseph E. (2002) Stiglitz. Globalization and its Discontents. New York-London: W.W. Norton & Company. (in English)

35. Rainert Erik S. (2015) *Yak bahati krainy zabahatily i chomu bidni krainy lyshaiutsia bidnymy* [How rich countries got rich ... and why poor countries remain poor]. Per. z anhl. Pereklad z anhliiskoi Petra Tereshchuka. Kyiv: Tempora. (in Ukrainian)

36. Koliadenko S. V. (2016) Tsyfrova ekonomika: peredumovy ta etapy stanovlennia v Ukraini i u sviti [The digital economy: preconditions and stages of formation in Ukraine and in the world]. *Ekonomika, finansy, menedzhment: aktual'ni pytannia nauky i praktyky – Economy, finances, management: topical issues of science and practical activity,* no. 6 (10), pp. 105–112. (in Ukrainian)

37. Kovorkynh: bolshye perspektyvy malenkoho formata [Coworking: Big prospects for small format]. Available at: https://www.arendator.ru/articles/5/art/63751/ (accessed October 18, 2022). (in Ukrainian)

38. Istoriya kovorkinga [History of coworking]. Available at: http://www.tikitoki.com/timeline/entry/156192/The-History-Of-Coworking-PresentedBy Deskmag#vars !date= 1995-05-28_08:55:49 (accessed October 31, 2022). (in Ukrainian)

39. Snihur Kh. (2017) Kovorkinh: perevahy ta nedoliky v orhanizatsii robochykh mists [Coworking: the advantages and disadvantages of organizing jobs]. *Visnyk Ternopilskoho natsionalnoho ekonomichnoho universytetu – Bulletin of the Ternopil National Economic University,* no. 4, pp. 117–124. (in Ukrainian)

40. Lytvynova S. H. Virtualnyi klas yak kompiuterno-oriientovne navchalne seredovyshche vchytelia zahalnoosvitnoho navchalnoho zakladu [Virtual Classroom as a Computer-Oriented Educational Environment for a Primary School Teacher]. Available at: http://lib.iitta.gov.ua/197/1/statja-4.pdf (accessed December 25, 2022). (in Ukrainian)

41. Cloud Supply Chain Management Market. Available at: https://bit.ly/3mRIyhb (accessed December 25, 2022). (in English)

42. Oksfordskyi instytut Internetu, Oksfordskyi universytet (2014) Chym ye v pryntsypi tekhnolohichnyi innovatsiinyi khab [What is a technological innovation hub in principle] Available at: http://cii.oii.ox.ac.uk/2014/09/16/what-is-a-tech-innovation-hub-anyway (accessed December 25, 2022). (in Ukrainian)

43. Obiednannia pidpryiemstv ta yoho vydy. Available at: https://wiki.legalaid.gov.ua (accessed December 27, 2022). (in Ukrainian)

44. Zhosan H. (2020) Stan rozvytku didzhytalizatsii v Ukraini [The state of digitalization development in Ukraine]. *Ekonomichnyi analiz – Economic analysis,* vol. 30. no. 1 (2), pp. 44–52. (in Ukrainian)

45.Vykorystannia informatsiino-komunikatsiinykh tekhnolohii na pidpryiemstvakh. Ofitsiinyi sait Derzhavnoi sluzhby statystyky Ukrainy [Use of information and communication technologies at enterprises. Official website of the State Statistics Service of Ukraine]. Available at: http://www.ukrstat.gov.ua (accessed October 31, 2022). (in Ukrainian)

46 Cukhomlyn L. V. (2020) Zastosuvannia informatsiinykh tekhnolohii dlia udoskonalennia vnutrishnikh lohistychnykh protsesiv kompanii [Application of information technologies to improve internal logistics processes of the company].

Investytsii: praktyka ta dosvid – Investments: practice and experience, no. 24. pp. 44–50. DOI: 10.32702/2306-6814.2020.24.44.

47. Nazvani naipopuliarnishi IT-rishennia dlia lohistyky mynuloho roku. Logist.FM [Named the most popular IT solutions for logistics last year. Logist. FM]. Available at: https://logist.fm/news/nazvani-naypopulyarnishi-it-rishennya-dlya-logistiki-minulogo-roku (accessed November 11, 2022). (in Ukrainian)

48. Homeniuk M. O. (2020) Rozvytok lohistyky na osnovi vprovadzhennia protsesiv didzhytalizatsii [Development of logistics based on the implementation of digitization processes]. *Efektyvna ekonomika – Efficient economy,* no. 2. DOI: 10.32702/2307-2105-2020.2.51. Available at: http://www.economy.nayka.com.ua/pdf/2_2020/53.pdf (accessed October 31, 2022). (in Ukrainian)

49. Chukurna O. P., Nitsenko V. S., Hanzhurenko I. V., Honcharuk N. R. (2019) Directions of Innovative Development of Transport Logistics in Ukraine. *Economic Innovations,* vol. *21.* no. 1 (70), pp. 170–181. DOI: https://doi.org/10.31520/ei.2019.21.1(70).170-181. (in English)

50. Chukurna O. P., Nitsenko V. S., Mykhailova M. V., Odynokov R. D. (2018) Udoskonalennia systemy skladskoi lohistyky v konteksti tekhnolohii «Industrii 4.0» [Improving the system of warehousing logistics in the context of technology «Industry 4.0»]. *Ekonomichna stratehiia i perspektyvy rozvytku sfery torhivli ta posluh – Economic strategy and prospects for the development of trade and services, no.* 1 (27), pp. 220–232. (in Ukrainian)

51. Lipkova L., Braga D. (2016) Measuring commercialization success of innovations in the EU. *Marketing and Management of Innovations*, no. 4, pp. 15–30. (in English)

52. Lyulyov O. V., Pimonenko T. V. (2017) Lotka-Volterra model as an instrument of the investment and innovative processes stability analysis. *Marketing and Management of Innovations*, no. 1, pp. 159–169. DOI: http://doi.org/10.21272/mmi.1-14. (in English)

53. Liubkina, O., Murovana, T., Magomedova A., Siskos, E., & Akimova, L. (2019) Financial Instruments of Stimulating Innovative Activities of Enterprises and Their Improvements. *Marketing and Management of Innovations*, no. 4, pp. 336–352. DOI: http://doi.org/10.21272/mmi.2019.4-26. (in English)

54. Witkowski W., Huk K., Perzyńska A. (2016) Selected it solutions in logistics strategies of supply chains. *ActaLogistica,* no. 3 (4), pp. 31–37. DOI: https://doi.org/10.22306/al.v3i4.75. (in English)

55. Douglas M. (2019) Logistics IT Market Research Survey. *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/2019-top-100-logistics-it-providers-and-market-research-survey (accessed October 22, 2022). (in English)

56. Douglas M. (2020) Logistics IT Market Research Survey. *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/2020-logistics-it-market-research-survey (accessed October 22, 2022). (in English)

57. Gavurova B., Bacik R., Fedorko R., Rigelsky M. (2018) Analytical view of online marketing tools in the dimension of marketing campaigns' personalization in Slovakia. *Marketing and Management of Innovations*, no. 2, pp. 186–200. DOI: http://doi.org/10.21272/mmi.2018.2-15. (in English)

58. Duester R. (2020) The High Cost of Invisibility. *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/the-high-cost-of-invisibility (accessed October 22, 2022). (in English)

59. Nitsenko V., Kotenko S., Hanzhurenko I., Mardani A., Stashkevych I., Karakai M. (2020) Mathematical Modeling of Multimodal Transportation Risks. In: Ghazali R., Nawi N., Deris M., Abawajy J. (Eds.) Recent Advances on Soft Computing and Data Mining. SCDM 2020. *Advances in Intelligent Systems and Computing, 978*. Springer, Cham. DOI: https://doi.org/10.1007/978-3-030-36056-6_4. (in English)

60. Strutynska L. R., Aftanaziv I. S., Strogan O. I., Ortynska N. V. (2018) Determining the sites of optimal location of regional logistics centers. *Naukovyi Visnyk NHU – Scientific Bulletin of NSU*, no. 6, pp. 148–155. (in English)

61. Koliadenko S., Golubkova I., Babachenko M., Levinska T., Burmaka L. (2020) Development and use of it solutions in logistics. *Financial and Credit Activity Problems of Theory and Practice*, vol. 3 (34). pp. 230–236. DOI: https://doi.org/10.18371/fcaptp.v3i34.215518. (in English)

62. Kyianytsia L. L. (2019) The One Belt One Road Initiative as a New Silk Road: The (Potential) Place of Ukraine. *Ukrainian Policymaker,* no. 4, pp. 21–26. DOI: https://doi.org/10.29202/up/4/3. (in English)

63. Bilan Yu., Nitsenko V., Ushkarenko I., Chmut A., Sharapa O. (2017) Outsourcing in international economic relations. *Montenegrin Journal of Economics,* no. 13 (3), pp. 175–185. DOI: https://doi.org/10.14254/1800-5845/2017.13-3.14. (in English)

64. Wiggins J. P. (2017) TMS Systems Have Changed Dramatically. Your Buying Process Should Too. *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/how-your-TMS-buying-process-should-change-dramatically (accessed January 22, 2023). (in English)

65. IT Gap? 3PLs Close the Loop (2019). *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/it-gap-3pls-close-the-loop/ (accessed January 22, 2023). (in English)

66. 2020 Top 100 Logistics IT Providers. (2020) *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/article/2020-top-100-logistics-it-providers (accessed January 22, 2023). (in English)

67. Arabe K. (2020) Spotlight. Technology Innovations. *Inbound Logistics.* Available at: https://www.inboundlogistics.com/cms/tags/articles/logistics-it. (accessed January 22, 2023). (in English)

68. AsstrA-Associated Traffic AG. Available at: https://asstra.com.ua/ukr/novini-asstra/2019/06/simbioz-it-i-transportnogo- biznesu (accessed January 22, 2023). (in Ukrainian)

69. Nitsenko V., Mukoviz V., Sharapa O. (2017) Accounting of transaction expenses of economic entities. *Scientific Bulletin of Polissia,* vol. 4 (12), no. 2, pp. 71–78. DOI: https://doi.org/10.25140/2410-9576-2017-2-4(12)-71-78. (in English)

70. Logistics, supply chain and transportation 2023: change at breakneck speed (2018). *Forbes Insights*. Available at: https://www.forbes.com/forbes-insights/our-work/transportation-2023 (accessed January 22, 2023). (in English)