

Electronic scientific and practical journal
**INTELLECTUALIZATION OF LOGISTICS
AND SUPPLY CHAIN MANAGEMENT**

#2 (2020)
July '20



WWW.SMART-SCM.ORG

ISSN 2708-3195

DOI.ORG/10.46783/SMART-SCM/2020-2

ISSN 2708-3195



9 772708 1319005



Electronic scientific and practical publication in economic sciences

ISSN 2708-3195

DOI: <https://doi.org/10.46783/smart-scm/2020-2>

Released 6 times a year

№ 2 (2020)
July 2020

Kyiv - 2020

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In 2020, the International Center for Periodicals (ISSN International Center, Paris) included the Electronic Scientific and Practical Edition "Intellectualization of Supply Chain Management" in the international register of periodicals and provided it with a numerical code of international identification: ISSN 2708-3195 (Online).

Recommended for dissemination on the Internet by the Academic Council of the Department of Logistics NAU (No. 7 of February 26, 2020). Released 6 times a year. Editions references are required. The view of the editorial board does not always coincide with that of the authors.

t.me/smart_scm
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DOI: <https://doi.org/10.46783/smart-scm/2020-2>
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тел.: (063) 593-30-41
<https://smart-scm.org>

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UDC 004.338.47

DOI: <https://doi.org/10.46783/smart-scm/2020-2-8>

JEL Classification: L86, M15, O32, O33.

Received: 30 July 2020

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CURRENT STATE AND PROSPECTS OF DIGITAL TRANSFORMATION OF THE TRANSPORT AND LOGISTICS SECTOR OF UKRAINE

Kateryna Kopishynska. "Current state and prospects of digital transformation of the transport and logistics sector of Ukraine". *The article examines the current state of digital transformation of enterprises in the transport and logistics sector and identifies key prospects for its development. Diagnosis of Ukraine's results in the international rankings, which determine the intensity and direction of use of digital technologies and ICT by countries, found that the country's position on these indicators is average or below average among the studied countries. Analysis of the evaluation of the innovation index of Ukrainian companies for enterprises in the transport and logistics sector revealed that most of the innovations implemented by enterprises relate to digital technologies and ICT. However, these companies are technological market leaders and do not fully reflect the trends of the entire industry. Analysis of the use of ICT in the transport and logistics sector by domestic enterprises showed that in 2019 almost 90% of enterprises use the Internet in their activities, only 22% have their own website, and less than 9% of the total number of enterprises in the sector use cloud computing. In 2020, due to the emergence of coronavirus disease (COVID-19) and the implementation of quarantine measures to prevent its spread, there were significant changes in the functioning of the world economy in general, and the transport and logistics sector in particular. To determine the prospects for the digital transformation of the transport and logistics sector, it was proposed to define them by levels and directions. Four main levels of digital transformation were proposed: microlevel (internal management and business processes of the enterprise), mesolevel (interaction of the enterprise with consumers, clients and partners), macrolevel (interaction of the enterprise with the state and state regulation and management) and megalevel (harmonization with international rules and integration with international infrastructure). Among the most promising areas are proposed the automation of management and production processes, the Internet of Things, artificial intelligence, robotics, last mile delivery, warehouse automation, blockchain, data analysis, cloud computing, autonomous vehicles.*

Keywords: digitalization, digital transformation, logistics and transport, innovations, management.

Катерина Копішинська. «Сучасний стан та перспективи цифрової трансформації транспортно-логістичного сектору України». У статті досліджено сучасний стан цифрової трансформації підприємств транспортно-логістичного сектору та визначено ключові перспективи її розвитку. Діагностика результатів України в міжнародних рейтингах, які визначають інтенсивність та напрями використання цифрових технологій та ІКТ країнами встановила, що позиції країни за цими показниками є середніми або нижче середніх серед досліджуваних країн. Аналіз оцінки індексу інновацій українських компаній для підприємств

транспортно-логістичного сектору. виявив, що більшість інновацій, які впроваджують підприємства, відносяться до цифрових технологій та ІКТ. Проте ці підприємства є технологічними лідерами ринку і не відображають повною мірою тенденцій усієї галузі. Аналіз використання вітчизняними підприємствами транспортно-логістичного сектору ІКТ показав, що у 2019 році майже 90 % підприємств використовують Інтернет в діяльності, лише 22 % мають власний сайт, а хмарними обчисленнями користується менше 9% загальної кількості підприємств сектору. У 2020 році внаслідок появи коронавірусної хвороби (COVID-19) та запровадження карантинних заходів щодо запобігання її поширення відбулись істотні зміни у функціонуванні світової економіки в цілому, та транспортно-логістичного сектору зокрема. Для визначення перспектив цифрової трансформації транспортно-логістичного сектору було запропоновано визначати їх за рівнями та напрямками. Було запропоновано чотири основні рівні цифрової трансформації: мікрорівень (внутрішні управлінські та бізнес-процеси підприємства), мезорівень (взаємодія підприємства зі споживачами, клієнтами та партнерами), макрорівень (взаємодія підприємства з державою та державне регулювання і управління) та мегарівень (гармонізація з міжнародними правилами та інтеграція з міжнародною інфраструктурою). Серед найбільш перспективних напрямів обрано автоматизацію управлінських та виробничих процесів, інтернет речей, штучний інтелект, робототехніку, доставки останньої милі, автоматизацію складів, блокчейн, аналізу даних, хмарні обчислення, автономні транспортні засоби.

Ключові слова: цифровізація, цифрова трансформація, логістика та транспорт, інновації, управління.

Екатерина Копишинская. «Текущее состояние и перспективы цифровой трансформации транспортно-логистического сектора Украины». В статье исследовано текущее состояние цифровой трансформации предприятий транспортно-логистического сектора и определены ключевые перспективы ее развития. Диагностика результатов Украины в международных рейтингах, которые определяют интенсивность и направления использования цифровых технологий и ИКТ странами установила, что позиции страны по этим показателям являются средними или ниже средних среди исследуемых стран. Анализ оценки индекса инноваций украинских компаний для предприятий транспортно-логистического сектора показал, что большинство инноваций, которые внедряют предприятия, относятся к цифровым технологиям и ИКТ. Однако эти предприятия являются технологическими лидерами рынка и не отражают в полной мере тенденций всей отрасли. Анализ использования отечественными предприятиями транспортно-логистического сектора ИКТ продемонстрировал, что в 2019 году почти 90% предприятий используют Интернет в деятельности, лишь 22% имеют собственный сайт, а облачными вычислениями пользуется менее 9% общего количества предприятий сектора. В 2020 году в результате появления коронавирусной болезни (COVID-19) и введения карантинных мероприятий по предотвращению ее распространения состоялись существенные изменения в функционировании мировой экономики в целом, и транспортно-логистического сектора в частности. Для определения перспектив цифровой трансформации транспортно-логистического сектора было предложено определять их по уровням и направлениям. Было предложено четыре основных уровня цифровой трансформации: микроуровень (внутренние управленческие и бизнес-процессы предприятия), мезоуровень (взаимодействие предприятия с потребителями, клиентами и партнерами), макроуровень (взаимодействие предприятия с государством и государственное регулирование и управление) и мегауровень (гармонизация с международными правилами и интеграция с международной инфраструктурой). Среди наиболее перспективных направлений предложены автоматизация управленческих и производственных процессов, интернет вещей, искусственный интеллект, робототехника, доставка последней мили, автоматизация складов, блокчейн, анализ данных, облачные вычисления, автономные транспортные средства.

Ключевые слова: цифровізація, цифрова трансформація, логістика і транспорт, інновації, управління.

Introduction. The functioning of enterprises in all spheres of activity in the conditions of constant changes in the external environment, economic crisis and uncertainty on the one hand, it would seem, do not contribute to the intensification of innovation. On the other hand, the active implementation of the latest developments in science and technology can provide the company not only to increase the efficiency of its activities, but also the prospects of market leadership, including technology. The era of digital transformation of society began in the twentieth century and is significantly intensifying every year in the twenty-first century. It can be said that a significant "leap" in this direction occurred in 2020 due to the spread of coronavirus disease (COVID-19), which caused significant restrictions on population mobility and slowing world trade. After all, the lack of "live" communication with partners (clients, contractors) as a result of quarantine measures introduced by many countries has intensified the use of information and communication technologies (ICT), digital technologies and the Internet in management and business processes of almost all enterprises. Enterprises in the transport and logistics sector were no exception to the general trend and were also forced to either start or continue their own digital transformation. How quickly and successfully such transformational changes can be implemented depends on the current state of digitalization of enterprises and their innovation orientation in general, as well as on the ability of management to form long-term strategies for enterprise development in modern conditions.

Analysis of recent research and publications. The issue of digital transformation of the economy in general and the transport and logistics sector in particular is currently quite relevant, so many Ukrainian and foreign scientists, as well as specialized organizations are studying it. Thus, the International Telecommunication Union (ITU) and the IMD World Competitiveness Center

study the use of ICT and digital technologies at the global level and form country rankings on these indicators. PricewaterhouseCoopers has been researching key trends in logistics and transportation for several years, including under the influence of digitalization. Among domestic researchers to the impact of ICT and digital technology in the transport and logistics sector dedicated their work O. I. Nikiforuk, O. M. Stasiuk, L. Yu Chmyrova, N. O., Fediai, S. A. Filatov, L. M. Golovchenko, K.O. Sichkarenko, and others. However, the actual state of ICT use by enterprises in the transport and logistics sector remains insufficiently studied, and the impact of COVID-19 on changes in the digital transformations of the sector needs further clarification.

The purpose and objectives of the study. The purpose of the study is to analyze the current state of digital transformation of transport and logistics activities of enterprises and determine the directions and prospects for its development in Ukraine. To achieve this purpose, the tasks to be solved are identified, namely: to analyze the use of ICT by enterprises of the transport and logistics sector, to determine the features of the sector working in the quarantine restrictions imposed by the spread of COVID-19, and their impact on digital transformation of transport and logistics activities, to suggest directions of perspective development of digitalization of the sector.

Basic material and results. As already mentioned, the use of innovations in the activities of enterprises can significantly improve the results of their operation and become the basis for active development and long-term competitiveness. Digital transformation is inherently innovative. According to the definition of the Concept of development of the digital economy and society of Ukraine for 2018-2020, "digitalization - saturation of the physical world with electronic-digital devices, tools, systems and electronic communication between them, which actually allows integrated interaction of virtual and physical, ie creates cyberphysical space "[1].

Digital transformations of business is the result of digitalization, namely the process that involves the introduction of innovative information and digital technologies and devices in order to optimize and improve the efficiency of activities in general, as well as maximize customer and partner needs. "Mind" and its partners have developed the Innovation Index of Ukrainian companies and evaluated 50 domestic companies from 10 sectors of the economy that are implementing the largest transformations, including the transport and logistics sector. The innovativeness of companies was

evaluated by product characteristics, business processes, business models and customer service [2]. Most of the innovations implemented by companies, including transport and logistics, relate to information and digital technologies. The results of the assessment of the innovativeness of the largest companies in the transport and logistics sector are presented in table. 1. (according to the calculation methodology, the maximum score of the index is 100, but none of the studied industries has received such a result)

Table 1

The innovativeness index assessment of Ukrainian companies "Mind Innovation Index" for enterprises of the transport and logistics sector in 2019

	TOTAL Index	Innovativeness of the product	Innovativeness of the business processes	Innovativeness of the business models	Innovativeness in working with clients
Transport and logistics	80				
Nova Poshta	76	70	78	71	81
Boryspil Airport	55	50	64	48	53
Ukrposhta	54	42	59	48	50
UIA	54	39	64	45	57
Ukrzaliznytsia	40	33	47	27	40

Source: [2]

The leading companies in the transport and logistics sector according to the innovativeness index have implemented the following key innovations, which have also become a significant step in the process of implementing their digital transformation: Nova Poshta - launch of automated sorting terminals; Boryspil Airport - launch of self-check-in and baggage check-in machines; Ukrposhta - business transformation and active implementation of IT solutions in activities; UIA - call center optimization; Ukrzaliznytsia - implementation of a website and a mobile application for buying tickets for passengers, a system of electronic distribution of carriages for freight [2]. To determine the current state of digital

transformation of the transport and logistics sector, it is necessary to form a system of indicators by which it is evaluated, as well as to take into account the general trends of digitalization at the national level. Global research in this area has been conducted for a long time. According to the IMD World Digital Competitiveness Ranking 2019, Ukraine ranked 59-60 in the period 2015-2019 (while the average rankings of 40 countries in Europe-Middle East-Africa show 38-40 positions) [3]. The ICT Development Index for 2012-2017 shows the change in Ukraine's position from 71 in 2012 to 79 in 2017 [4]. However, the authors and developers of this rating decided to clarify and supplement the indicators on which the accounting is carried

out and currently the updated rating has not been submitted. Analyzing the place of Ukraine in the presented ratings of digitalization and ICT implementation, we can determine the level of digital transformation of the country as an average or below average, which should be taken into account when analyzing the digital transformation of each sector of the economy.

The selection and collection of indicators for the analysis of digitalization and development of ICT for each separate field of activity and the country as a whole is the subject of discussions at the international level, and the situation with the delay in publishing the updated ICT Development

Index is additional confirmation. The State Statistics Service of Ukraine collects the information on the use of ICT in the activities of enterprises on a list of indicators, which has many items, but is not exhaustive and does not include, in particular, information on the use of such innovative digital and ICT as the Internet of Things (IoT), Blockchain, Artificial intelligence (AI), Augmented reality (AR), 3D printing, etc. Thus, we analyze the use of ICT by enterprises of the transport and logistics sector on the following selected indicators: the availability of Internet access, the availability of its own website, the use of the website, the use of cloud computing and its directions (Fig. 1-3).

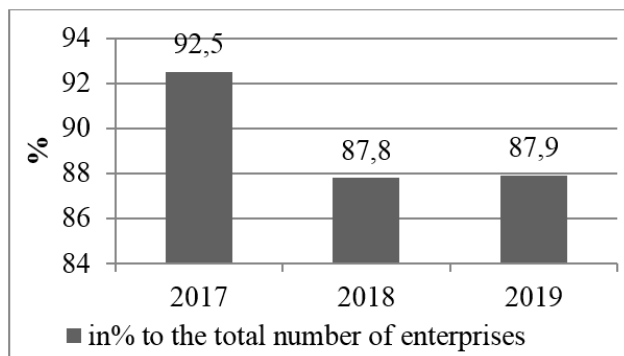


Figure 1a - The share of enterprises in the transport and logistics sector that had access to the Internet

Source: compiled by the author according to the data [5]

According to the data presented in Fig. 1a, we can see that the share of enterprises in the transport and logistics sector that had access to the Internet for the period 2017-2019 is quite high, although there is a tendency to decrease, although the absolute figures, according to statistics, are growing. This may be due to the fact that the growth of the total number of enterprises in this area is growing faster than the process of connecting them to the Internet. One of the indicators of

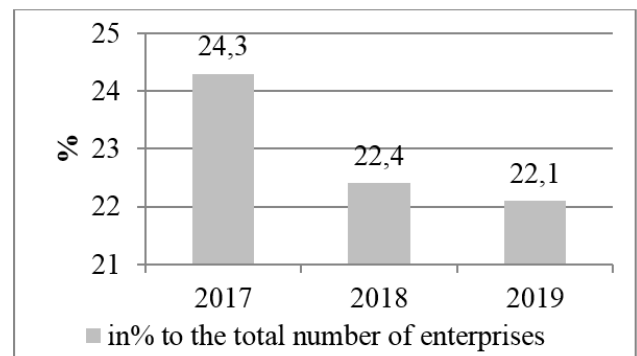


Figure 1b - The share of enterprises in the transport and logistics sector that had a website

the use of ICT in the activities of enterprises is the presence of its own website (Fig. 1b). As you can see, the general trend of a slight decrease in the indicator in the study period persists, which can also be explained by the fact that new companies spend some time developing and launching their own site. It is also advisable to consider in more detail the possibility of providing interactive services that can provide enterprise's own website (Fig. 2).

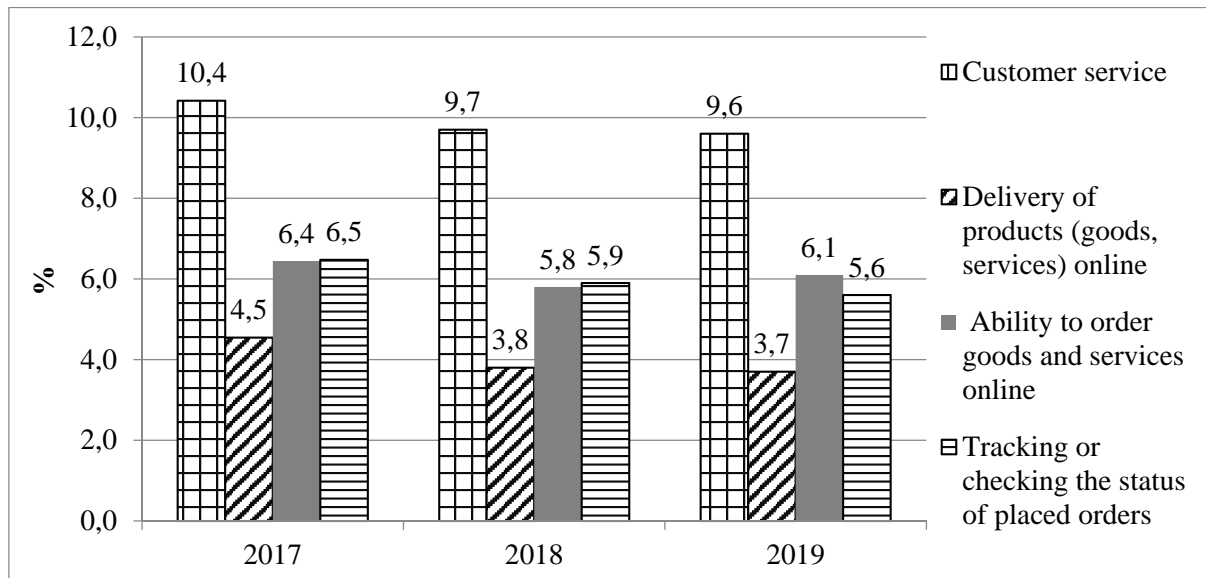


Figure 2 - The share of enterprises of transport and logistics sector, which had a website that provided the possibility of providing interactive services
 Source: compiled by the author according to the data [5]

There is a small amount of involvement of the websites of transport and logistics companies in providing opportunities of interactive services. This can be due to many factors, including: reluctance or distrust of customers to use the website as a tool for communication with the company, lack of relevant clear information about communication with the company through the site, Internet outages, mismatch of quality of interactive services through the company's website expectations customers, etc.

The use of cloud computing in the activities of enterprises in the transport and logistics sector allows them to work better and faster, process information and interact with customers. According to statistics on the number of enterprises in the sector that use cloud computing, in 2017 they were 7,9% of

the total number of enterprises, in 2018 – 7,5%, and in 2019 – 8,1%. [5].

As you can see, the number of companies buying cloud computing services is very small and does not exceed 9% of the total number of companies. It is worth noting that some of these services are quite expensive, and small businesses cannot afford them, but the not all companies have the need to use such services. Although the constant deepening of the process of digitalization of the transport and logistics sector will contribute to further growth in the use of cloud computing not only by large enterprises and market leaders, but also by small players, as their cost will decrease and functionality will improve. Fig. 3 presents the structure of the use of cloud computing services.

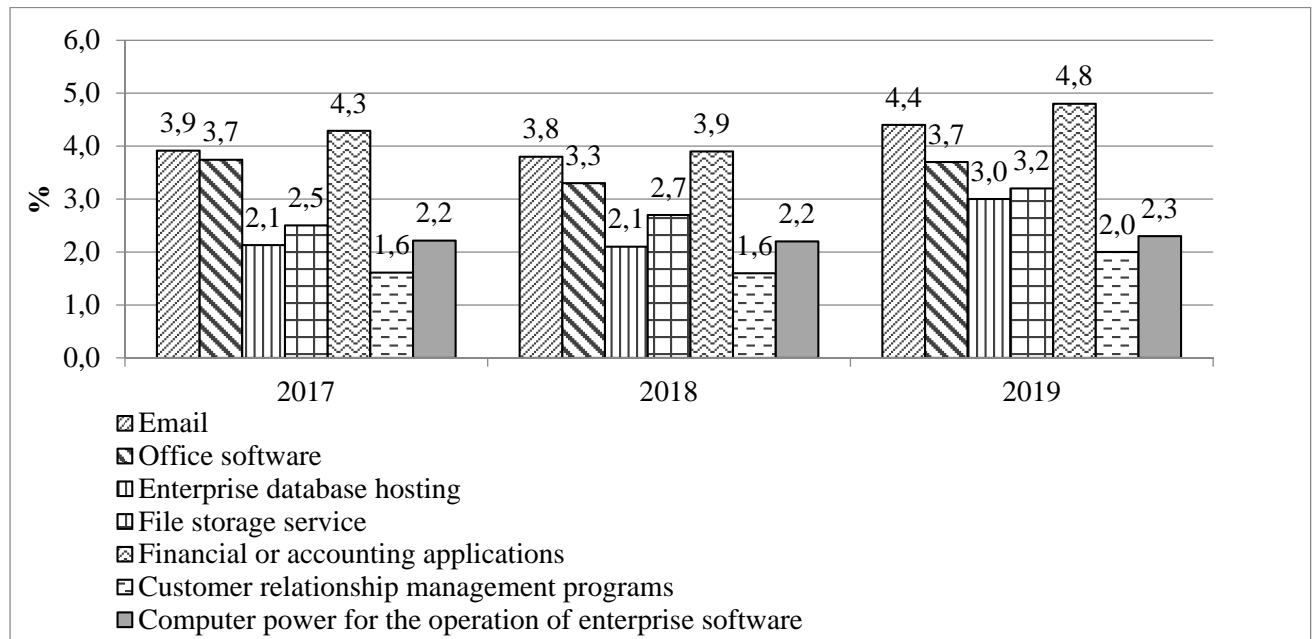


Figure 3 - The share of enterprises of transport and logistics sector which bought cloud computing services by the type of service

Source: compiled by the author according to the data [5]

It is worth noting that the presented trends in the implementation of ICT by enterprises of the transport and logistics sector may undergo significant changes starting in 2020. After all, during the spread of COVID-19 and the implementation of quarantine restrictions in the activities of many enterprises in the sector, significant changes took place. For example, the efficiency of transport and postal and courier companies will differ significantly in all areas, including digital transformation.

Analyzing the structure of the sector and the peculiarities of its work during the quarantine period, it should be noted that the most negative impact was on transport. In the first 6 months of 2020. cargo turnover of transport enterprises amounted to 80,4% of the volume of the same period in 2019. In

2020, transport enterprises transported only 83,7% of cargo from January – June 2019. Transport companies engaged in passenger transportation have suffered much greater losses. Thus, in the first six months of 2020, the turnover of transport enterprises amounted to 80,4% of the volume of the same period in 2019, and the volume of transported goods in January-June 2020 amounted to 83,7% of the volume of the same period in 2019. Transport companies engaged in passenger transportation have suffered even greater losses. In particular, the passenger turnover of transport enterprises in the first half of 2020 amounted to only 44,1% of the corresponding period of 2019, and the number of passengers in January-June 2020 decreased to 56,6% compared to the same period in 2019 [5] (Fig. 4, a, b).

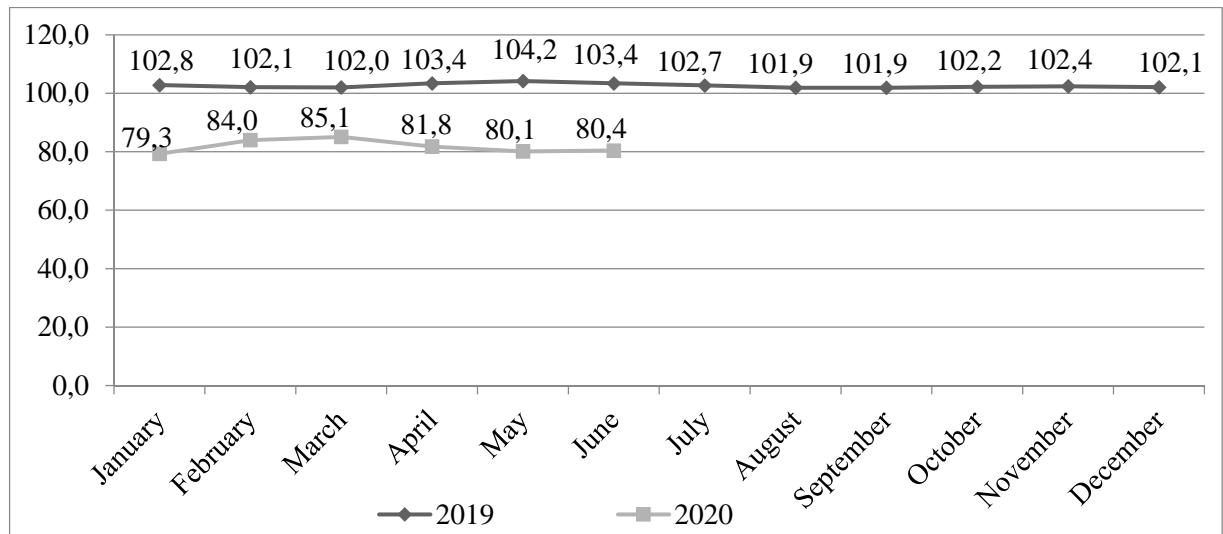


Figure 4a - Freight turnover of transport enterprises, in% to the corresponding period of the previous year, cumulative total

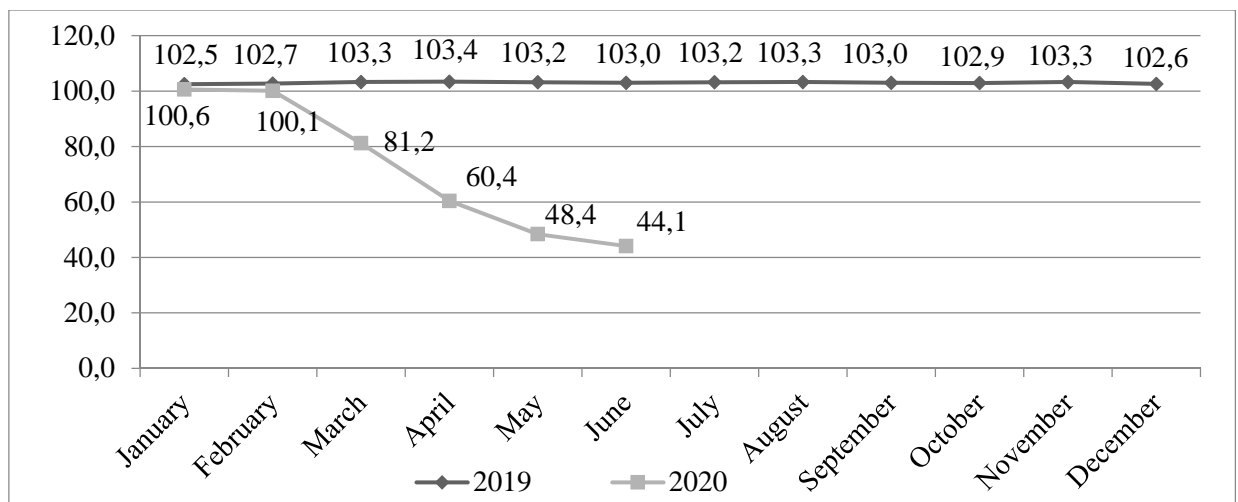


Figure 4b - Passenger turnover of transport enterprises, in% to the corresponding period of the previous year, cumulative total

Source: [5]

The largest decline in transport performance was experienced by air passenger traffic. This trend is global in nature. According to IATA specialists, passenger traffic forecast drop in 2020 is about -51%. At the global level, the decline in passenger and freight traffic is more sharp than the decline in GDP in 2020, and their slow recovery is expected from 2021 [6]. However, it is well known that big crises are the impetus for the development of innovation and transformation of established business models and the crisis of 2020, caused by the spread of the coronavirus disease COVID-19 is no exception. Now it is no longer

a desire, but the need to remove a human from many processes to ensure the safety of his life, becomes the start for the active dissemination and implementation of digital and information and communication technologies. Identification of the trends in the transport and logistics sector under the influence of ICT and digital technologies are presented in many studies, and their general principles are largely the same [7, 8, 9, 10] StartUs Insights has identified 10 trends in logistics that will affect companies in 2020 and beyond in the future (represented by the degree of influence in%): Internet of Things - 17%, Artificial Intelligence - 14%, Robotics -

11%, Last Mile Delivery - 11%, Warehouse Automation - 11%, Blockchain - 10%, Data analytics - 9%, Cloud Computing - 8%, Autonomous Vehicles - 5%, Elastic Logistics - 4% [8]. More than half of these technologies are already beginning to be used by enterprises of the domestic transport and

logistics sector, but the use of some of them requires preparation not only at the micro level, ie at the enterprise level, but also at the national level, ie at the macro level.

Fig. 5 presents the key levels and directions of digital transformation of the transport and logistics sector of Ukraine.

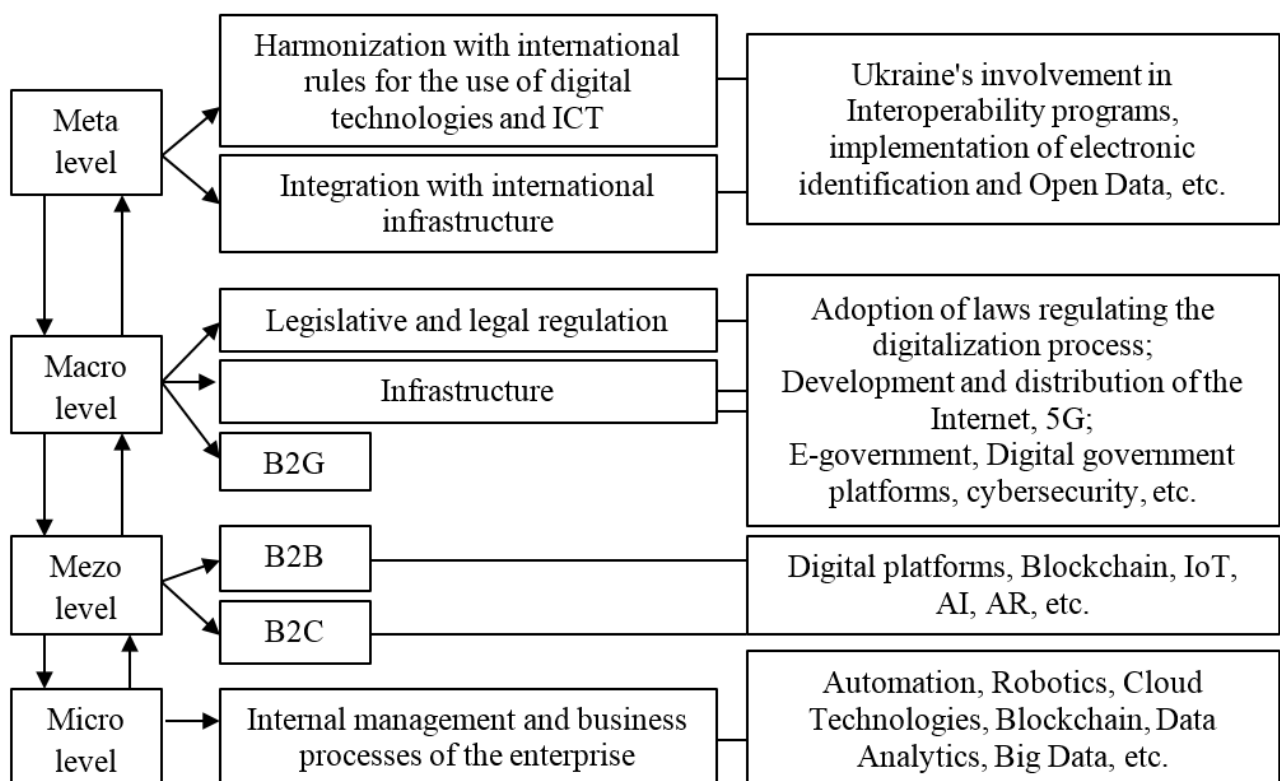


Figure 5 – Levels and directions of digital transformation of the transport and logistics sector
 Source: developed by the author

Digital transformation at the micro level involves changes in the internal business processes of the enterprise, ie ways and means of organizing and managing its activities. Shown in Fig. 5 directions of digital transformation can be used by small enterprises as well as 3PL, 4PL and 5PL operators. Automation can apply to both production and management processes, and can be used by both transport and courier companies and warehousing companies. Digital warehouses, for example, combine technologies such as Automation, Robotics, Cloud Technology, Data Analytics, Blockchain, and so on.

Robotization is also relevant for the domestic transport and logistics sector, in

particular, in the performance of loading and unloading operations, works related to the repair and maintenance of technical means. After all, modern cargo terminals in developed countries have essentially a robotic industry in which using digital programs without direct human participation take place most of these processes [11, 12].

A separate important issue in the process of digital transformation is the analysis and storage of data. Transport and logistics companies usually accumulate a large amount of heterogeneous information in their form, content and source of origin. After processing and analysis, the information is used by management to make management decisions. The larger the company, the larger

the data sets that need to be stored and processed. "Big Data" is used to organize, store, and analyze unstructured information. In today's world, a large number of companies collect extremely large amounts of information about their customers, clients, customers, determine their preferences to form an individualized offer and maximize the level of their satisfaction. Transport and logistics companies collect data from sensors on vehicles, cargo, equipment, portable devices, data on the location of vehicles in real time, information on traffic jams, data from mobile applications, information from shippers and recipients, etc. All this data needs to be stored and processed [13]. Therefore, the use of Big Data and Data Analytics are also becoming necessary components of the digital transformation of the transport and logistics sector.

The interaction of the enterprise with customers, partners and consumers (meso-level of digital transformation) today can take place contactlessly using digital platforms. Examples of such domestic digital platforms in the field of road transport are Degruz, Della, Flagma, Lardi-Trans, which provide a request from the owner of the goods for transportation of goods, and from the owner of the vehicle - for the provision of transportation services. Recognized as the most innovative company in the transport and logistics sector, Nova Poshta has long planned to start delivering parcels using drones, and, taking into account the peculiarities of doing business in quarantine, will probably make every effort to implement the planned as soon as possible.

In recent years, the process of digital transformation at the macro level has intensified significantly. The key principles of digital transformation of Ukraine's economy are set out in two main documents: "Concepts of development of digital economy and society of Ukraine for 2018-2020" [1] and "Digital Agenda of Ukraine - 2020" [14], which define the principles, measures and the plan of implementation digital transformation. However, there is currently no legal

regulation of this process, which significantly complicates the provision of cybersecurity by the state. The opening of the "Electronic Customs" became important for the transport and logistics sector, which significantly simplified and accelerated the border crossing process. Ukrainian e-service of public services "Diia", developed by the Ministry of Digital Transformation, is a mobile application with digital documents and a portal with public services. The digital driver's license allowed users to drive without a physical driver's license, and the patrol police - to check the documents and identity of the driver on an online request to the register. Ukraine has become one of the 10 countries in the world that have introduced such a service. Electronic driver's licenses and electronic vehicle registration certificates are digital versions of documents, not their alternatives [15].

An important issue of the mega-level for the digital transformation of Ukraine is the coordination and harmonization with international rules and regulations on the use of digital technologies and ICT. Among them are the following [14, 16]:

1. Ukraine's accession to the EU Program Interoperability Solutions for European Public Administrations 2 (ISA2), e-CODEX projects, e-Invoicing, as well as the Single Digital Gateway initiative.

2. Implementation of eIDAS regulations in Ukraine, including the introduction of cross-border electronic identification and authentication and accession to the EU project Stork 2.0.

3. Implementation of an electronic interaction system to EU requirements, in particular the European Interoperability Framework 2.0.

4. Implementation of eIDAS regulations in Ukraine, including accession to the EU project Stork 2.0.

5. Integration of the state web portal of open data of Ukraine data.gov.ua into the central European portal of open data europeandataportal.eu and data.europa.eu.

6. Official recognition of all international standards of the Alimentarius Code system, and the standards that form the basis of "Logistics 4.0".

7. Implementation of works on harmonization of "Electronic Customs" documents with EU requirements and introduction of the Single Administrative Document (SAD).

8. Organization of compatibility of the current control system for the movement of goods, which is used in the customs authorities of Ukraine, with the European NCTS [14, 16].

The COVID-19 pandemic has made significant changes in the economic and social life of the world's population. Given the objective need to eliminate a human from as many business processes as possible, the pace of digital transformation will continue to accelerate. Therefore, identifying the directions of such transformations in the transport and logistics sector will allow focusing efforts on specific and promising transformations, and getting the maximum benefits from such changes.

Conclusions. New challenges always create new opportunities. In today's world, digital technologies and ICT, which are used in all areas of economic activity, are becoming increasingly important. The digital transformation of the transport and logistics sector has already begun and is in the process of active transformation. The quarantine restrictions imposed by the spread of coronavirus COVID-19 have become an additional catalyst for these changes. In Ukraine, there are companies that can be called technological leaders in the industry,

which actively use digital technologies and ICT in their activities, have a strategic vision of its prospects and their own digital transformation (Nova Poshta, Ukrposhta, etc.). However, so far there are not so many. Analysis of data on the use of ICT in the transport and logistics sector by enterprises showed that less than 25% of enterprises have their own website, and even fewer use it to provide interactive services. And cloud computing is used by less than 10% of enterprises in the sector. The development of digital infrastructure is gradually turning companies into a contactless mode of interaction with consumers and customers through digital platforms. There are significant changes in the process of digital transformation at the macro level. Thus, since 2019, the Ministry of Digital Transformation has been established and is actively functioning in Ukraine, which was created for this purpose. The benefits of using some of the results of its activities (e-service of public services "Diia") could already be felt by transport companies. But important issues that have not yet been resolved by the state are the legislative regulation of digital transformation, as well as the harmonization of updated rules and standards with international rules and regulations for the use of digital technologies and ICT. As for the directions of digital transformation of the transport and logistics sector of Ukraine, they correspond to global trends, i.e. the use in the Automation of Management and Production processes, the Internet of Things, Artificial Intelligence, Robotics, Last Mile Delivery, Warehouse Automation, Blockchain, Data Analytics, Cloud Computing, Autonomous vehicles.

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