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## FORMATION OF THE MULTIMODAL TRANSPORTATION ECOSYSTEM IN UKRAINE

**Mariia Hryhorak, Oksana Karpenko, Myroslava Semeriahina.** *"Formation of the multimodal transportation ecosystem in Ukraine".* The article is devoted to the problem of formation of multimodal transport ecosystem in Ukraine and reveals features of mutual relations of participants of the logistic service market in the digital economy conditions. In the process of the study, the fragmentary and multi-vector nature of the existing regulatory and legal support of logistics activities in Ukraine, freight forwarding and transportation of goods by different modes of transport were determined. The conclusion is made about the need for legislative support of multimodal transportation, taking into account environmental requirements and current trends in the digitalization of the logistics business to ensure the delivery of goods "door to door". The necessity of an ecosystem approach to the development of the concept of multimodal transport development and ensuring the partnership of market participants in order to create an integrated multimodal service is proved. The structure of the multimodal transport ecosystem in Ukraine is proposed, which provides the possibility of vertical and horizontal interaction of market participants, standardization of logistics processes, unification of cargo batches and automation of procedures related to document management in a single information system. Based on statistical analysis, the main problems and opportunities for the development of multimodal transport in Ukraine have been identified. It is concluded that the removal of existing barriers can be a powerful stimulus to improve the quality of multimodal logistics services and will realize the transit potential of Ukraine.

**Keywords:** business ecosystem, logistics services market, multimodal freight transport, multimodal logistics service, regulatory and legal regulation of logistics activities, potential of the national logistics system.

**Марія Григорак, Оксана Карпенко, Мирослава Семерягіна. «Формування екосистеми мультимодальних перевезень в Україні».** Стаття присвячена проблемі формування екосистеми мультимодальних перевезень в Україні і розкриває особливості взаємовідносин учасників ринку логістичних послуг в умовах цифрової економіки. В ході проведеного дослідження встановлено фрагментарність та різновекторність наявного нормативно-правового забезпечення логістичної діяльності в Україні, експедирування та перевезень вантажів різними видами транспорту. Зроблено висновок про необхідність законодавчого забезпечення мультимодальних перевезень з урахуванням екологічних вимог та сучасних трендів цифровізації логістичного бізнесу для забезпечення доставки вантажів «від дверей до дверей». Доведено необхідність екосистемного підходу до розроблення концепції розвитку мультимодальних перевезень та забезпечення партнерства учасників ринку з метою створення інтегрованого мультимодального сервісу. Запропоновано структуру екосистеми мультимодальних перевезень в Україні, яка забезпечує можливість вертикальної та горизонтальної взаємодії учасників ринку, стандартизації логістичних процесів, уніфікації вантажних партій та автоматизації процедур, пов'язаних з документооборотом в єдиній інформаційній системі. На основі статистичного аналізу визначено основні проблеми та можливості розвитку мультимодальних перевезень в Україні. Зроблено висновок, що усунення наявних бар'єрів може стати потужним стимулом для підвищення якості мультимодального логістичного сервісу та дозволить реалізувати транзитний потенціал України.

**Ключові слова:** бізнес-екосистема, ринок логістичних послуг, мультимодальні вантажні перевезення, мультимодальний логістичний сервіс, нормативно-правове регулювання логістичної діяльності, потенціал національної логістичної системи.

**Мария Григорак, Оксана Карпенко, Мирослава Семерягина. «Формирование экосистемы мультимодальных перевозок в Украине».** Статья посвящена проблеме формирования экосистемы мультимодальных перевозок в Украине и раскрывает особенности взаимоотношений участников рынка логистических услуг в условиях цифровой экономики. В ходе проведенного исследования установлено фрагментарность и разновекторность имеющегося нормативно-правового обеспечения логистической деятельности в Украине, экспедирувания и перевозки грузов разными видами транспорта. Сделан вывод о необходимости законодательного обеспечения мультимодальных перевозок с учетом экологических требований и современных трендов цифровизации логистического бизнеса для обеспечения доставки грузов «от двери до двери». Доказана необходимость экосистемного подхода к разработке концепции развития мультимодальных перевозок и обеспечения партнерства участников рынка с целью создания интегрированного мультимодального сервиса. Предложена структура экосистемы мультимодальных перевозок в Украине, которая обеспечивает возможность вертикальной и горизонтальной взаимодействия участников рынка, стандартизации логистических процессов, унификации грузовых партий и автоматизации процедур, связанных с документооборотом в единой информационной системе. На основе статистического анализа определены основные проблемы и возможности развития мультимодальных перевозок в Украине. Сделан вывод, что устранение имеющихся барьеров может стать мощным стимулом для повышения качества мультимодального логистического сервиса и позволит реализовать транзитный потенциал Украины.

**Ключевые слова:** бизнес-экосистема, рынок логистических услуг, мультимодальные грузовые перевозки, мультимодальный логистический сервис, нормативно-правовое регулирование логистической деятельности, потенциал национальной логистической системы.

**Introduction.** The global trend of the world economy is digitalization, which has a

transformational impact on business in general, and the market of logistics services in



particular. Digital technologies create unique opportunities for open communications and widespread collaboration of market participants and are a powerful catalyst for institutional change, enabling logistics companies to implement new business models and offer customers new services and logistics services. A recently published study [1] has used the term "FreightTech", which refers to the use of artificial intelligence, automation and integration technologies, which together revolutionize the logistics industry, and more. They change the processes of transportation and transshipment of goods, cargo handling and storage of goods, order processing and supply chain management. The growth of investment in FreightTech start-ups indicates the formation of intelligent clusters and transportation ecosystems (FreightTech ecosystem). Interviews of Roland Berger Economic experts with participants in the European freight market have revealed its strong fragmentation and multi-vector regulation of the current regulatory framework. Different policies of EU governments mean that logistics providers find it difficult to standardize processes, including cabotage rules and electronic document formats. This interferes the digitization of businesses. Large freight forwarders are investing heavily in the development of digital technologies, but smaller market players lack the funds to adapt their business models and they are losing market share. It is necessary to create regulatory legal prerequisites for digitalization of logistics business and identify data generation and processing real time for balanced development of the logistics service market and ensuring high-quality accomplishment of requirements of cargo owners (logistics service consumers) on the principles of "Door to Door" and "Just in Time".

On the other hand, climate change and enhancement of environmental problems actualize the issue of finding optimal logistics solutions aimed at reducing the harmful

effects on the environment. The principles of "green" logistics and closed-loop supply chains require a comprehensive approach to solving social, economic and environmental problems of the national economy. This is manifested in the implementation of the sustainable development concepts of the country and the prioritization of logistics solutions aimed at reducing harmful emissions and the use of more environmentally friendly modes of transport for the movement of goods both within the country and internationally. In this context, a special role belongs to the search for optimal multimodal schemes for transportation of goods and the development of incentives for their use. In accordance with the signed Association Agreement between the European Union and Ukraine, European norms and rules are being implemented in Ukraine, as well as the harmonization of various regulatory legal acts, including the regulation of transport development. However, the current regulatory and legal framework does not create sufficient conditions for efficient logistics and lags behind the real needs of the market environment. This is especially true of stimulating the development of multimodal transport and their legal regulation in the context of digitalization of the economy.

Thus, all this determines the relevance of the study of international experience in regulating the multimodal transport market in the context of reducing environmental impact, defining the conceptual prerequisites for creating an ecosystem of multimodal transport in Ukraine in accordance with the latest trends in logistics, and research of prospects for multimodal technologies through a prism of logistical service.

**Analysis of recent research and publications.** Legal regulation of the multimodal transportation development as a separate segment of the logistics service market is considered in the scientific literature in fragments. According to scientific study [2] it was determined that the key functions of multimodal transport management are the



offer of services of multimodal transport, management of multimodal transport systems and the development of new types of services. In accordance with these functions, key competencies and the roles of market participants have been defined. The authors of the scientific article [3] drew attention to the rethinking of traditional logistics services through the prism of intermodality and reviewed the methods of planning intermodal freight. The role and dynamics of the introduction of modern information and communication technologies in the field of multimodal transport in the EU have been studied in scientific article [4]. Scientific works [5-7] focus on environmental problems of transport and comparative analysis of costs and harmful emissions of multimodal technologies in comparison with road transport. The authors of the scientific article [8] have proved that container transportation is an effective way to reduce the carbon footprint, and also proposed a system of indicators and a model for evaluating the synergistic effect degree of reducing harmful emissions. The proposed system of indicators was further developed in the scientific article [9], which studied the role of rail transport in multimodal transport.

Many researchers pay attention to the role of multimodal transport for efficient supply chain management and justify the necessity to create an integrated multimodal transport network. This is crucial for companies to successfully implement processes in their supply chains both domestically and internationally. A new meta-model of the general intermodal transport network is proposed by the authors in a scientific article [10]. For operative decision-making, the model presents a detailed structure of the intermodal transport network and predicts its dynamic development with the help of modern information and communication technologies. The necessity for interaction of different types of transport and integration of multimodal transport participants has been proved in many scientific publications. In particular, the

scientific article [10] presents a theoretical approach related to transport and logistics clusters, identifies the main factors to increase their competitiveness in the regions of functioning. Transport multimodal nodes as the core of logistics clusters are able to solve both the task of coordinating the work of participants in the transport process within the existing transport system, and the task of modernizing the transport system and implementing innovations. In particular, leading Ukrainian scientists have studied the possibility of forming transport and logistics clusters in seaports [12] or airports [13]. Analysis of different points of view allows us to conclude that the main feature of the transport and logistics cluster is the concentration of a group of interdependent enterprises, organizations and companies in a given area, which provides competitive advantages of the regions.

The generalization of the latest trends in logistics development allows us to conclude about the growing role of business partnerships, the key to the success of which is the mutual use of resources and capacity with a synergistic effect of interaction of partner organizations. The new organizational form of partnership economic agents is ecosystem. The term "business ecosystem" was first proposed by J. Moore [14] in 1993. He has proposed to consider the company not as a participant in any one industry, but as a component of the business ecosystem, whose members "co-develop" around new innovations, collaborating and competitively supporting new products to meet customer needs. Deloitte published a thorough report "Business ecosystems come of age" in 2014 [11]. This report identifies that ecosystems are dynamic communities of diverse actors evolving together, creating and capturing new value through better models of simultaneous collaboration and competition.

The ecosystem approach is becoming increasingly popular in research because it reflects the real transformations of business configurations of logistics entities, is based on

the relationship and interdependence of logistics service production, environmental processes, human environment and thus integrating the economy, ecology and social processes of society. In a broad sense, the ecosystem approach is the methodological basis of many areas in science and practice. This provides an opportunity through the study of socio-natural integrity to determine its general changes in any effects on its components, its genesis with all the connections of components and objects, as well as to predict not only direct but also indirect effects of human impact on natural environment objects [15, p. 56]. In the context of our study, the principle thesis is the transition from static models of logistics systems to self-organizing systems. If the static system can be regulated only by the top, namely by the state's influence on organizations and institutions, the ecosystem has its own market mechanisms of self-development, meaning it is adjusted from below. This creates prerequisites for continuous innovation processes, eliminating excessive state intervention. The ecosystem approach draws attention to not so much on the participants of the system as the nature and dynamics of their interactions (with each other and with potential participants), emphasizing that the collaboration is seen as a horizontal and network environment for communication between all sectors and organizations. This ensures the creation and diffusion of knowledge flows, the transformation of these flows into innovations and the further spread of innovation throughout the economy. Logistics systems, built on the principles of three-pair interaction of the state, business and science, contain similar matrices of the triple spiral at the level of regions and production sectors. Similarly, manufacturing sectors built on a matrix of links can have regional, national and supranational scales, i.e. grow to macro-regional and global ones. The concept of the triple spiral shows that the way out of the technological trap and overcoming the dependence on the previous

vector of development is not in the gradual improvement of the technology itself, but in the improvement of the communication environment where it is used. This means that structural reforms that are in line with global economic trends need to be pursued, rather than simply borrowing advanced production technologies. Also, a comprehensive study of American scientific and technological societies "Future Knowledge Ecosystems" emphasizes that the new type of government should develop horizontal links, intercluster interactions and mechanisms for combining the resources of the territory with global markets [16].

**The purpose and objectives of the study.** The purpose of the study is to substantiate the feasibility of using an ecosystem approach for the multimodal transport development in Ukraine as a specific segment of the logistics service market, as well as to identify issues and ways to develop a multimodal logistics service. To achieve this goal, the following tasks are defined:

1) analysis of the existing regulatory and legal regulation of logistics activities and determining the direction of its improvement in order to development of the multimodal logistics service;

2) substantiation of feasibility of the ecosystem approach to formation of the concept of multimodal transport development and definition of structure of this ecosystem;

3) Identification of problematic issues and barriers which restrain the multimodal transport development in Ukraine and suggestion of ways to solve them.

**Basic material and results.** Generalizations of different points of experts' views on the processes taking place in the economy of Ukraine suggest that today its socio-economic life is governed by an eclectic mix of market mechanisms and archaic social institutions, which were only partially adapted to new economic conditions. The need, on the one hand, the evolutionary transition from one economic mode to

another one, and on the other hand, adaptation to a new paradigm of economic development (information, network, knowledge economy), greatly complicates the management processes of economic systems at different levels. This requires a clear understanding of the specifics of economic relations between businesses and authorities, and thus actualizes the organic relationship between technological innovation and the institutional environment. Ukraine is redefining the path and strategy of economic development in accordance with Association Agreement between the European Union and Ukraine. Paradigmatic transformational changes in the system of national economy are reflected in the system of the national economy management. This involves a radical change of macro-regulatory agencies, monitoring of the state of the economy and individual markets, regional and sectoral regulation, and regulation and monitoring of economic entities and their associations. The systemic stability of the national economy must be ensured by the stability of the subject core (state), the balance of the internal structure of each

subject (state, region, enterprise) and the systemic relationships between them.

Unfortunately, in Ukraine the existing regulatory and legal framework does not create sufficient conditions for efficient logistics and lags behind the real needs of the market environment. There are a large number of law regulatory acts that regulate only certain issues and procedures related to freight forwarding, customs and insurance. There is no word "logistics" in any current law regulatory act and, accordingly, the state does not create legal prerequisites for the effective implementation of concepts and tools of logistics in the activities of domestic businesses and so on. Certainly, the national legislation on logistics should define the mechanisms of state regulation, management and control in the field of logistics, entities, legal and organizational framework for logistics, the rights and obligations of the client and the business entity, contractual obligations in the provision of logistics services etc.

The analysis of the existing regulatory and legal support of logistics activities in Ukraine was allowed to identify the basic laws and codes presented in Table 1.

Table 1

Laws and Codes of Ukraine governing logistics activities

No.	Number and date of approval	Name and brief description
1.	Code on May 19, 2011, No. 3393-VI	Air Code of Ukraine. It establishes the legal framework for aviation activities and is aimed at ensuring aviation safety, ensuring the interests of the state, national security and the needs of society and the economy in air transport and aerial application.
2.	Code on May 23, 1995, No. 176/95-BP	The Merchant Shipping Code of Ukraine. It regulates the relations arising from merchant shipping, namely during activities related to the use of ships for the carriage of goods, passengers, luggage and mail, fishing and other marine fisheries, exploration and mining, towing, icebreaking and rescue operations, cable laying, as well as for other economic, scientific and cultural purposes.
3.	Law of Ukraine on December 23, 2004, No. 2286-IV	On Certified Warehouses and Ordinary and Twofold Warehouse Certificates. It regulates legal relations related to the registration, issuance, redemption of simple and twofold warehouse certificates, determines the procedure for their registration and aims to create legal, economic, organizational conditions for the operation of these documents during storage of goods in warehouses.
4.	Law of Ukraine on November 10,	On Transport. It defines the legal, economic, organizational and social foundations of transport.

No.	Number and date of approval	Name and brief description
	1994, No. 232/94-BP	
5.	Law of Ukraine on July 04, 1996, No. 273/96-BP	On Railway Transport. It defines the basic legal, economic and organizational principles of public railway transport, its role in the economy and social sphere of Ukraine. It regulates the relations of railway transport with executive authorities, local governments, other modes of transport, passengers, senders and consignees of cargo, baggage and mail, taking into account the specifics of the functioning of this mode of transport as a single production and technological complex.
6.	Law of Ukraine on April 05, 2001, No. 2344-III	On Road Transport. It defines the principles of organization and operation of road transport.
7.	Law of Ukraine on October 20, 1999, No. 1172-XIV	On Transit of Cargoes. It determines the principles of organization and transit of goods by air, road, rail, sea and river transport through the territory of Ukraine.
8.	Law of Ukraine on April 06, 2000, No. 1644-III	On Transportation of Dangerous Cargoes. It defines the legal, organizational, social and economic principles of activities related to the transport of dangerous goods by rail, sea, river, road and air transport.
9.	Law of Ukraine on July 01, 2004, No. 1955-IV	On Forwarding Activity. It defines the legal and organizational principles of forwarding activities in Ukraine and aims to create conditions for its development and improvement.
10.	Law of Ukraine on October 04, 2001, No. 2759-III	On Postal Service. It determines the legal, socio-economic and organizational basis of activities in the field of postal services, as well as regulates relations between public authorities and local governments, postal operators and users of their services.

*Source: compiled by the authors according to the data [17]*

Separate normative acts regulate the rules of passenger and cargo transportation, in particular:

- Rules of transportation by rail;
- Rules of air transportation of cargoes;
- Rules of cargo transportation by road in Ukraine;
- Rules for the carriage of goods in a direct mixed rail-water service.

Taking into account the considered regulatory and legal support the main aspects of logistic activity regulation is presented in general on Fig. 1, where we define the three main levels of regulation: international, national and level of enterprise.

It should be noted that Association Agreement between the European Union and

Ukraine encourages market participants in logistics services to implement in practice the EU regulations and directives on the formation of a single European transport area and reduce the harmful impact of the sector on the environment. The conceptual basis for EU regulation of logistics activities are summarized on Fig. 2.

Thus, the analysis of the contradictions of the existing legal acts concerning the activity of transport and the conceptual bases of the European logistics require adequate changes in the regulation of the logistics activity in Ukraine. One such act should be the Law on Multimodal Transportation, the draft of which is currently submitted to the Verkhovna Rada.

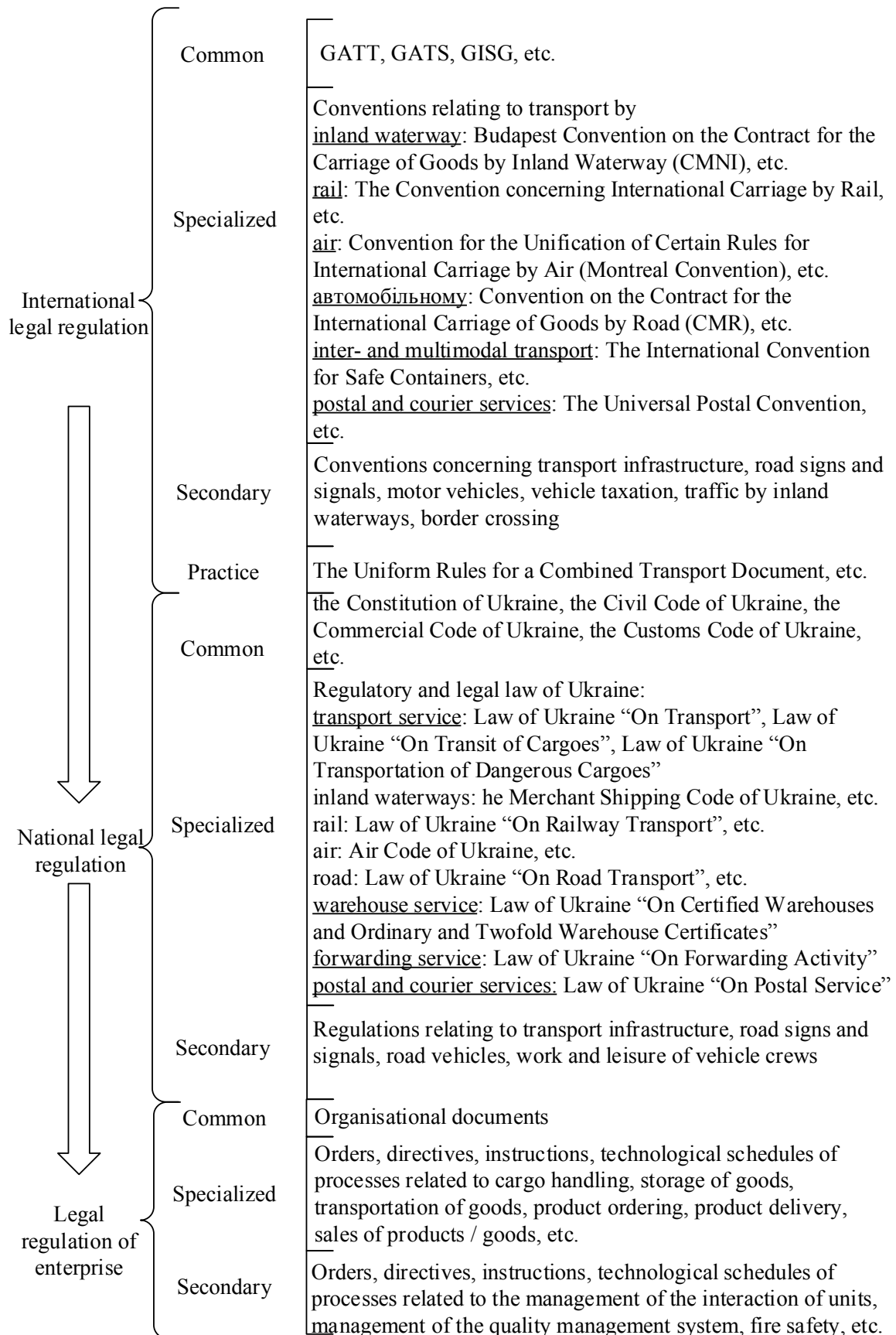


Figure 1 – Generalized scheme of legal regulation of logistics activity in Ukraine

Source: compiled by the authors according to the data [17]



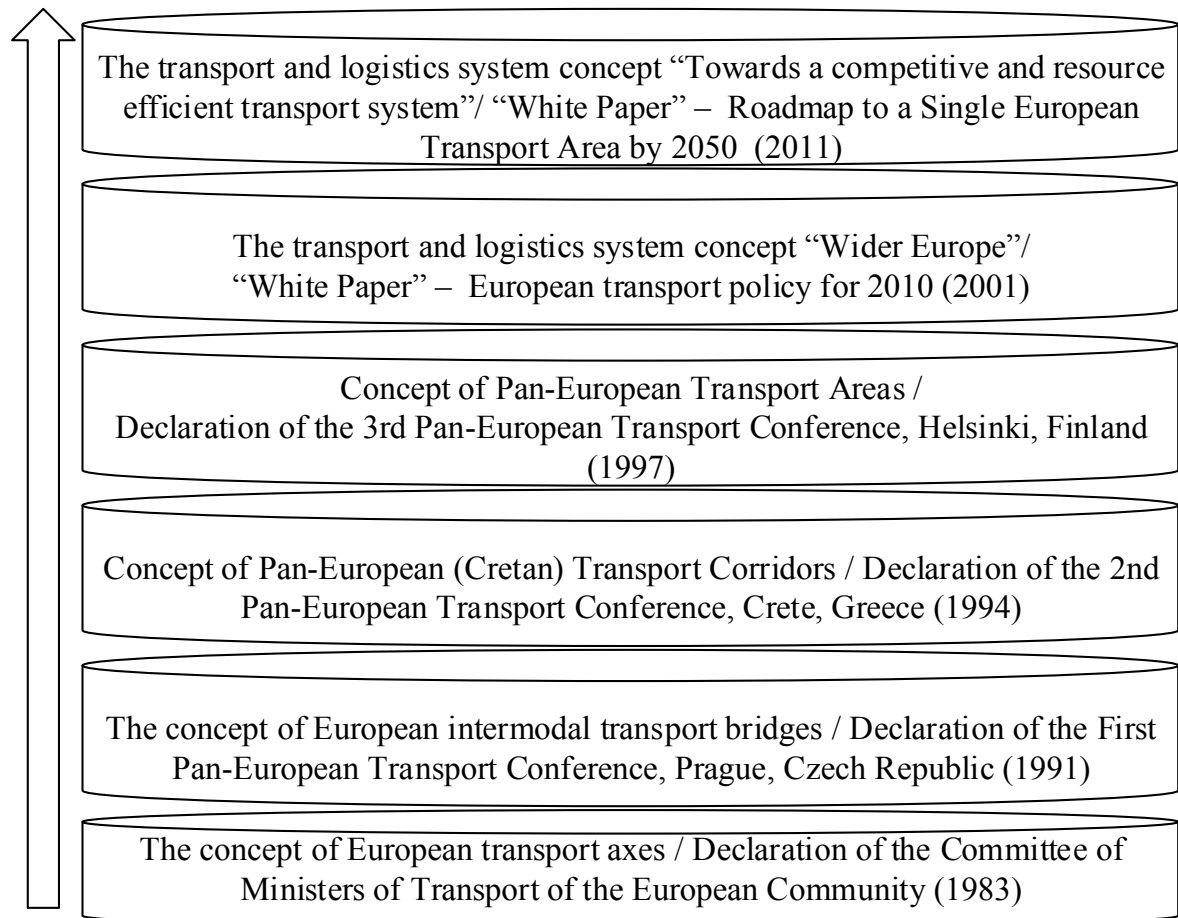


Figure 2 – Conceptual basis of European regulation of logistics activities

Source: compiled by the authors according to the data [18]

The draft law provides for the implementation of Council Directive 92/106 / EU of 7 December 1992 on the establishment of common rules for certain types of combined transport of goods between Member States. Despite some discussion about the content of the draft law most participants in the logistics service market note its positive role in the introduction of new technologies for freight transportation. The concept of multimodal transport development in Ukraine, which will contribute to the successful implementation of the future law is presented on Fig. 3.

Thus, the presented concept includes all the main stakeholders of multimodal transport and provides for the achievement of the state goal both in terms of European integration and environmental provisions, in addition, takes into account the economic positions of business entities, and provides a single information space for rapid information

interchange and cargo tracking. An important component of the proposed concept for the multimodal transport development is the definition of strategic imperatives as defining requirements for the throughput capability of multimodal networks. In the framework of our study, such provisions are:

- economic growth, especially budget-generating and export-oriented sectors of the economy;
- ensuring security of supply chains and mobility of the population;
- human capital development;
- reduction of harmful emissions from logistics activities;
- saving natural resources through recycling, effective public administration, technological dynamism and innovation.

Given the importance of the Law on Multimodal Transport for the development of the logistics services market, we believe that the initiative to improve the regulation of the

industry and the transport technologies development should be taken by business.

It can be developed a plan of measures needed to implement the concept of multimodal transport by finding a compromise between state institutions responsible for national and public security and the logistics business, which is interested in developing new delivery routes of goods, creating modern multimodal terminals. The key to mutual success, in our deep opinion, will be the creation of an ecosystem of multimodal transportation based on a digital platform.

In the ecosystem approach, managerial influences represent a set of unique non-cyclical solutions that form the concept of ecosystem development. The interaction of ecosystem participants with each other in the external environment is built in three ways: through partnership in an explicit form, secretly in a parasitic form and indirectly through network interconnections. The general structure of the multimodal transport ecosystem in Ukraine is presented on Fig. 4.

The process must be the same for all participants in order for ecosystem participants to be able to interact with each other in digital format. The same essence should be perceived in the only way by any participant of the system without additional steps such as special harmonization of terms, common understanding of documents and data analysis. For this approach to work, it is necessary to create and maintain a data model that will be accepted by all participants in the ecosystem. Standardization, unification and automation of logistics processes, information and technological evolution create preconditions for the formation and development of networks that enable intersectoral and international cooperation, as well as accelerate the creation of horizontal

and vertical partnerships within the chain of consumer value.

Intelligent logistics systems should work in real time in a single coordinate system and a single information space and thus create a methodological basis for optimizing logistics solutions and better use of existing logistics infrastructure. At the same time, they should contain not only modules of intelligent transport systems, intelligent technologies for monitoring vehicles and traffic flows, but also integrated software solutions for the interaction of enterprises in supply chains. The digital transformation of the logistics services market should be ensured with the help of information technologies for the implementation of multimodal transport on the principles of "Just in Time", "Door to Door" and "Just in Sequence". The main tools for the integration of freight and information flows should be unified protocols, documentation standards and interchange data systems, remote data access systems and mobile management.

Digital transformation of multimodal transport and, as a consequence, logistics service, requires concentration of investment resources on the development of transport and digital infrastructure.

Thus, we have noted the conceptual principles and directions of development of the logistics service market and the creation of the multimodal freight transport ecosystem in Ukraine. Let us consider the practical aspects and problems that currently have to be solved by state institutions in determining the roadmap of the implementation of the multimodal transport development concept. To do this, the statistics will be analyzed and the main trends associated with the use of different modes of transport in the national economy will be identified.



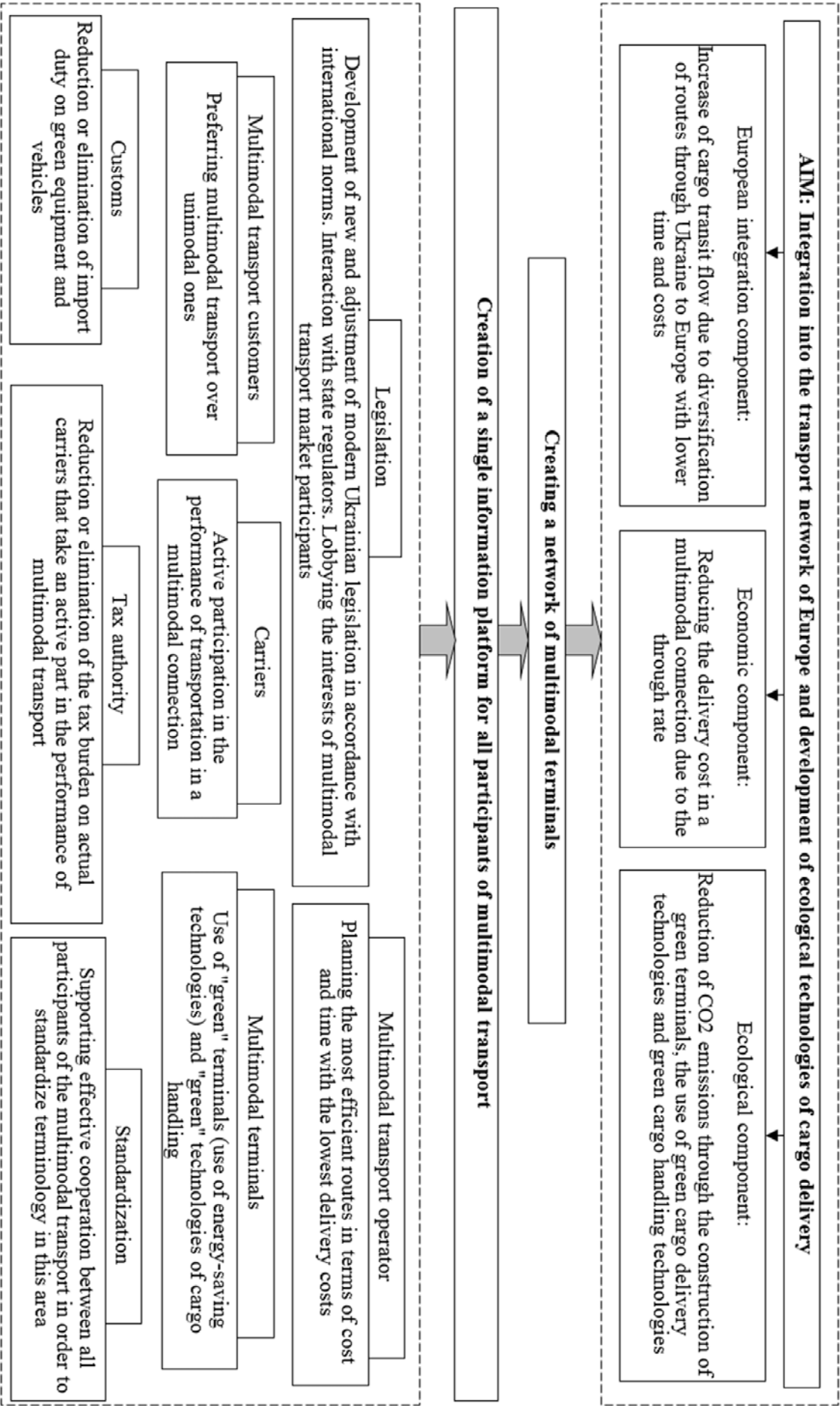


Figure 3 – Concept of multimodal transport development in Ukraine  
Source: developed by the authors

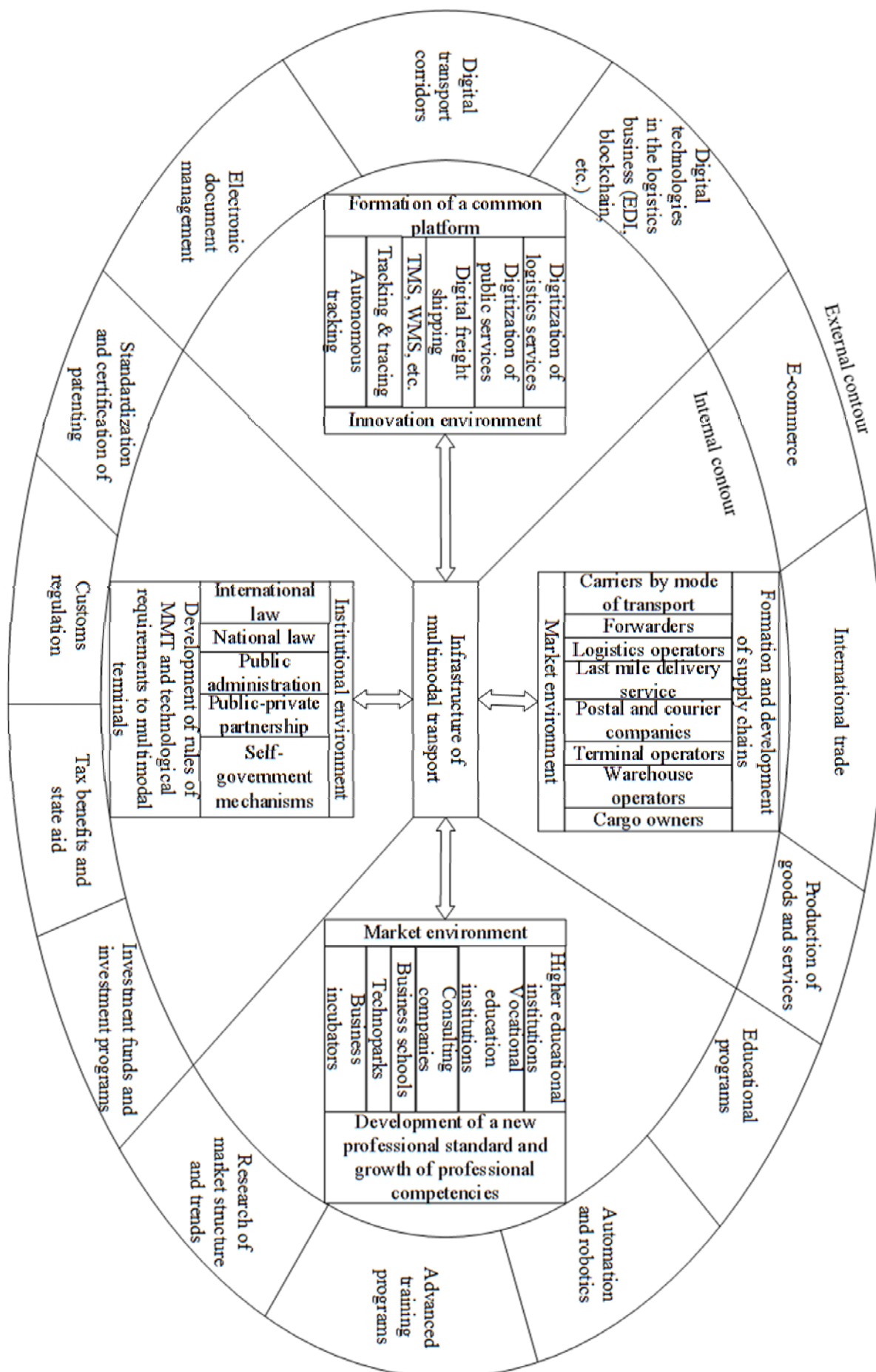


Figure 4 – Structure of the multimodal transport ecosystem in Ukraine  
 Source: developed by the authors

Let's analyze the main problems of multimodal transport development in Ukraine.

1) The growth of disparities between modes of transport.

According to the State Statistics Service of Ukraine on the volume of freight traffic in Ukraine, a sample was made for those modes of transport that should participate in the development of multimodal transport (excluding air and pipeline transport). The results are presented in Table 2 and 3.

The calculations show that the share of rail transport in the total volume of transported goods over the past 6 years has been steadily declining and reached 312.9 million tons in 2019, i.e. it was 21% of the total volume of transported goods by four modes of transport. For comparison: rail transport transported 514 million tons of cargo in 2007 and only 312.9 million tons were transported in 2019.

Table 2

Statistical data on the volume of cargo transportation by different modes of transport (thousand tons)

Mode of transport	2014	2015	2016	2017	2018	2019	% 2019/2018
Railway	386277	349995	343434	339551	322342	312939	97,08
Sea	2805	3292	3033	2253	1892	2120	112,05
River	3145	3156	3642	3640	3698	3990	107,90
Road	113131 3	102060 4	108566 3	112167 4	120553 1	114705 0	95,15
Total*	152353 9	137704 6	143577 1	146711 7	153346 3	146609 9	95,61

\* excluding air and pipeline transport

Source: compiled by the authors according to the data [19]

Table 3

The share of each mode of transport in total\* (%)

Mode of transport	2014	2015	2016	2017	2018	2019	Absolute deviation 2019 to 2018
Railway	25,35	25,42	23,92	23,14	21,02	21,35	0,32
Sea	0,18	0,24	0,21	0,15	0,12	0,14	0,02
River	0,21	0,23	0,25	0,25	0,24	0,27	0,03
Road	74,26	74,12	75,62	76,45	78,61	78,24	-0,38

\* excluding air and pipeline transport

Source: calculated on the basis of data [19]

On the contrary, the share of road transport in the volume of transported goods increased to 78% in 2019. The share of river transport remains at 0.2-0.3%. So, the total decline in UZ cargo transportation for the year amounted to -2.9% or -9.4 million tons. During the same period, road traffic decreased by 5%.

2) Mismatch in export-import trade flows.

The economic success of any country depends on its trade, and this is not surprising, because trade is one of the leading

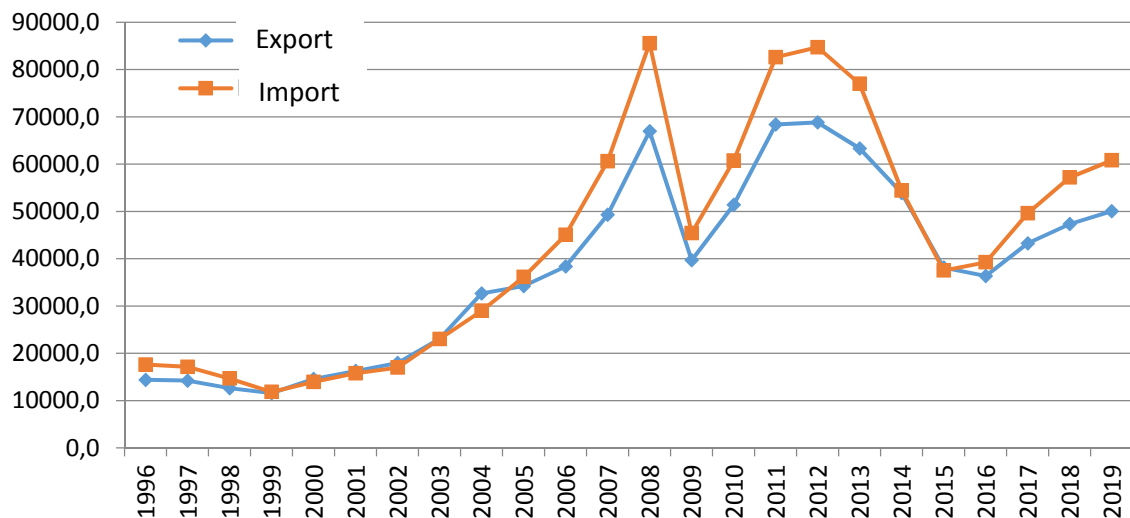
places in terms of impact on economic development. International trade overcomes the narrowness of the market, limited resources, increases the possibility of introducing new technologies and provides an opportunity to use the country's resources more efficiently.

The dynamics of imports and exports of goods and services of Ukraine for 1996-2019 are presented on Fig.5.

According to statistics for the last five years, imports in most cases prevail over

exports, while the negative balance of foreign trade has increased over the past two years, which is considered a rather bad trend in world practice. These data indicate a significant imbalance and a significant advantage of imports over exports, as well as significant fluctuations in volumes depending on the economic situation in the country.

Ukraine's main trading partners in 2018 and 2019 were 212 countries, the main of which are: China, Poland, Italy, Turkey, Germany, India, Hungary, Belarus, Russia, USA, France, Czech Republic, Sweden, Switzerland, Austria.



\* Since 2014, excluding the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and part of the temporarily occupied territories in Donetsk and Luhansk regions

Figure 5 – Dynamics of exports and imports of goods and services in Ukraine (million USD)  
Source: compiled by the authors according to the data [19]

Thus, after the loss of one of the largest trading partners, the vector of Ukraine's foreign trade relations changed. If earlier a significant part of export-import operations accounted for the Russian Federation, then after the restructuring of foreign trade guidelines, Ukraine got a chance to deepen trade relations with the European Union and Europe as a whole.

Ukraine belongs to the countries with raw material potential, ie it exports raw materials abroad, and there they process and return them to us in the form of finished imported goods, which is extremely inefficient. The key items of Ukrainian exports are still goods with a low level of processing or low added value, which indicates the extremely inefficient use of natural resources.

Thus, in 2019, the structure of exports was dominated by products of plant origin i.e. agricultural products (wheat, corn, canola), their part was 25.8%. In second place are base metals and articles thereof (mainly ferrous metals and semi-finished products), their part was 20.5%. Fats and oils of animal or vegetable origin (mainly sunflower oil) accounted for 9.5% of total exports, and mineral products (mainly iron ore) were 9.7%. Almost all products are transported in bulk or in bulk.

The largest net importers of agricultural products are the European Union, Russia, Japan, China, South Korea, Saudi Arabia, Algeria, the United Arab Emirates (UAE) and Venezuela.

In the structure of imports in 2019, machinery, equipment and mechanisms

accounted for 21.9%, oil and petroleum products were 20%, mineral products were 12.3%, land vehicles were 10.1%. Most of these products are imported to Ukraine in containers.

### 3) Low container traffic.

The main trend in the development of domestic and world transport is the rapid growth of container traffic, which provides increased safety of goods, significantly accelerates transshipment and delivery, increases the competitiveness and environmental friendliness of transport products.

The operator of combined transportation on the railways of Ukraine is Branch "Center of Transport Service "Liski"" of the Joint Stock Company "Ukrainian Railways", which owns terminals in Kiev, Dnepropetrovsk, Donetsk, Kharkov, Lugansk, Odessa, Chop and provides comprehensive freight forwarding services, using the benefits of combined.

Currently, Ukrzaliznytsia has organized the container trains and combined transport trains in the direction of international transport corridors, as well as the territory of Ukraine (Fig.6).

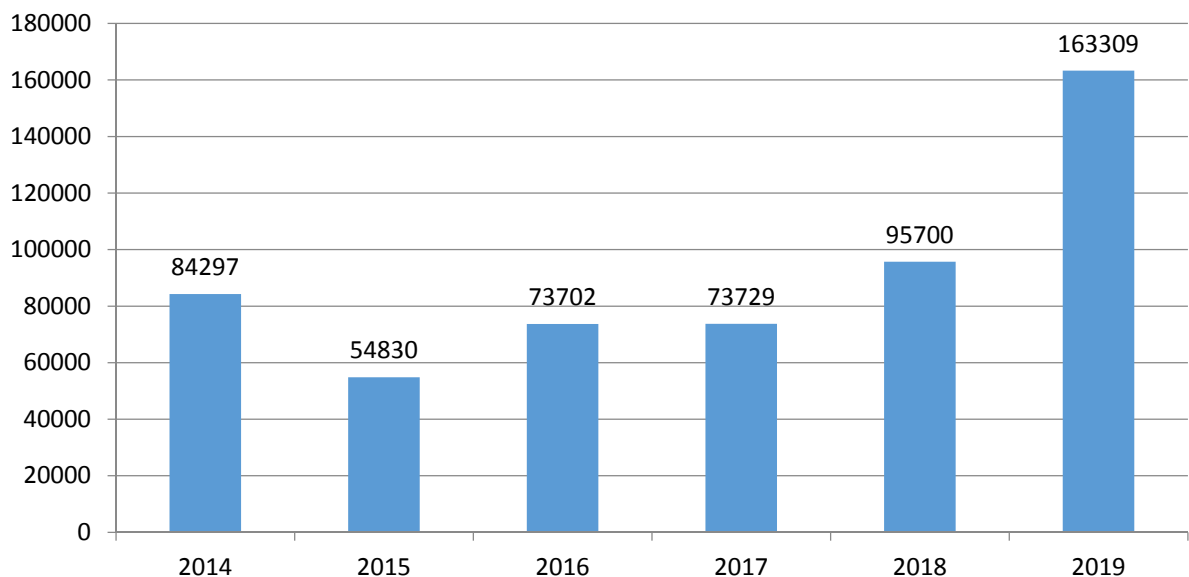


Figure 6 – Total containers as a part of container trains

Source: compiled by the authors according to the data [20]

In total, 163,309 containers were transported in 2019 in conventional units, which is 71% more than in 2018. The largest increase was observed in domestic destinations: in particular, on the route "Kyiv-Liski - Odessa-port" the volume of transported containers increased 4.8 times compared to 2018, it increased 3.9 times respectively on the route "Kharkiv-Liski - Black Sea", it increased in 3 times on the route "Dnipro-Liski - Odessa-port", it increased in 2.7 times on the route "Ternopil - Black Sea", it increased in 4.2

times on the route "Odessa-port - Kharkiv-Liski".

Statistical data on the dynamics of container turnover in seaports of Ukraine for 16 years are presented Fig. 7. The structure of container handling in ports of Ukraine for 2019 is presented in Table 4.

In 2019, the number of containers handled at Ukrainian terminals exceeded 1,007 million TEU mark. Transportations through Ukrainian ports are carried out by 15 shipping companies. 14 companies carry out transportation to the Odessa seaport, 2

companies (Maersk and MSC) carry to the Black Sea fishing port and only Maersk carries

to the port "Pivdennyi". In general, this is a very positive trend.

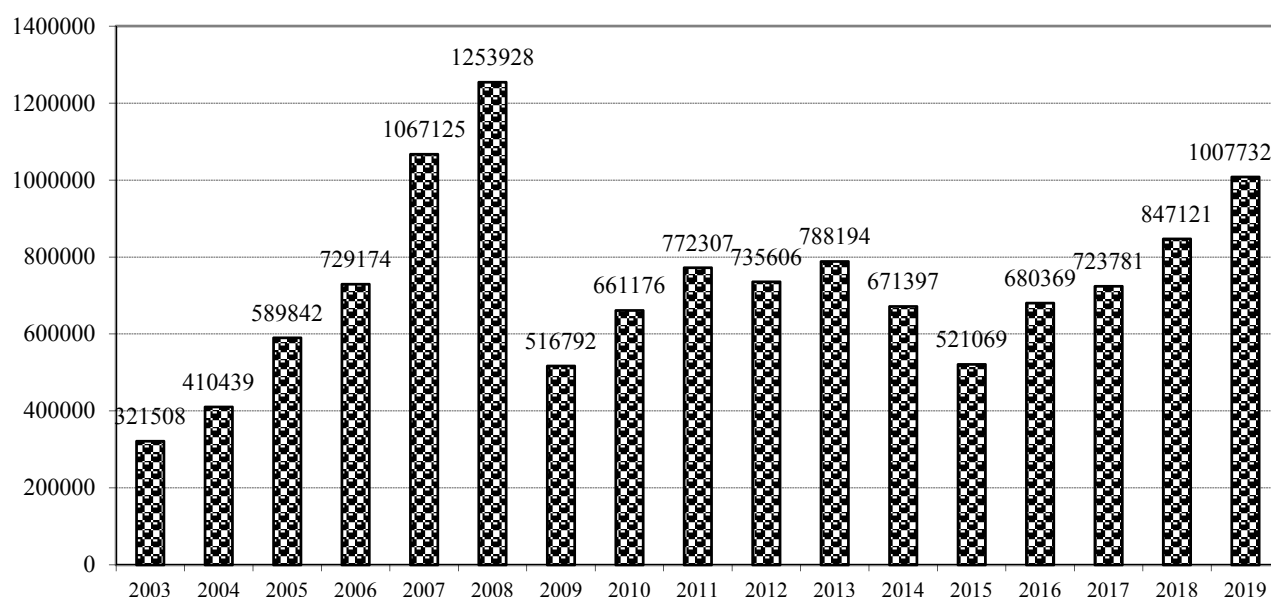


Figure 7 – Dynamics of container turnover in seaports of Ukraine, TEU

Source: [21]

Table 4

Structure of container processing in seaports of Ukraine, TEU

Ports	Import			Export			Total	% before 2018
	Loaded	Empty	Total	Loaded	Empty	Total		
Odessa ICC, including	301152	32794	333946	234068	81408	315476	649422	108,5
Container Terminal Odessa	186578	14805	201383	134948	55109	190057	391440	115,8
Brooklyn-Kyiv Port	114574	17989	132563	99120	26299	125419	257982	99,0
MP Southern (TIS CT)	84087	27621	111708	94873	12079	106952	218660	175,0
Black Sea fishing port	48913	10779	59692	57439	22358	79797	139489	113,3
Total	434152	71194	505346	386380	115845	502225	1007732*	119,0

\* incl. 159 TEU handled into SMP "Olbia" and 2 TEU handled in the port of Reni

Source: [21]

In the structure of container flows passing through Ukrainian ports, a balance remains between imports (50.1%) and exports (49.9%). In 2019, in terms of the number of loaded containers (820532 TEU), Ukrainian ports exceeded the peak indicators of 2008 (728416

TEU). Traditionally, the share of loaded containers is higher in imports than in exports. That is more loaded than imported than sent for export. Last year, loaded 434,152 TEU were imported to Ukraine, 386,380 TEU were exported. The growth rate of loaded



containers in imports is slightly higher than in exports: 19.4% and 16.3%, respectively. As for empty containers, their volumes are also growing, but empty containers are more sent from Ukraine (115845 TEU, + 34.6%) than imported (71194 TEU, + 9.7%). The share of empty in the total container turnover is 18.6%.

The highest growth rates in 2019 were demonstrated by TIS KT. A significant role in this was played by the transition to the terminal from the Odessa port of the direct Maersk service. MEZ, in addition to the direct Maersk ECUMED service that is already coming to TIS KK. And also the launch of a new weekly Maersk feeder service connecting the terminal with the Georgian port of Poti, which included Ukraine in the route of the Europe-Caucasus-Asia transport corridor (TRASECA). The TIS KT container terminal has become the

only one in Ukraine that operates in transshipment mode today.

Container trains are one of the most developing logistics areas of TIS. Together with Maersk and Ukraziliznytsya, regular routes were organized in the direction of the Dnieper, Kiev, Kharkov, Ternopil, Chernigov. Today, TIS weekly sends 15 regular trainees.

In the port of Odessa, within the framework of the development of intermodal transportation, 14 regular container trains run in the directions: Kiev, Dnieper, Kharkov, Vinnitsa, Rozhnatov, Verkhnedneprovsk and others. In 2010, only 15% of containers were shipped from the Odessa port by rail. Today almost a third of all containers are handled in the port. The rest are transported by road.

The analysis of container traffic on the Dnieper River is shown in Fig. 8.

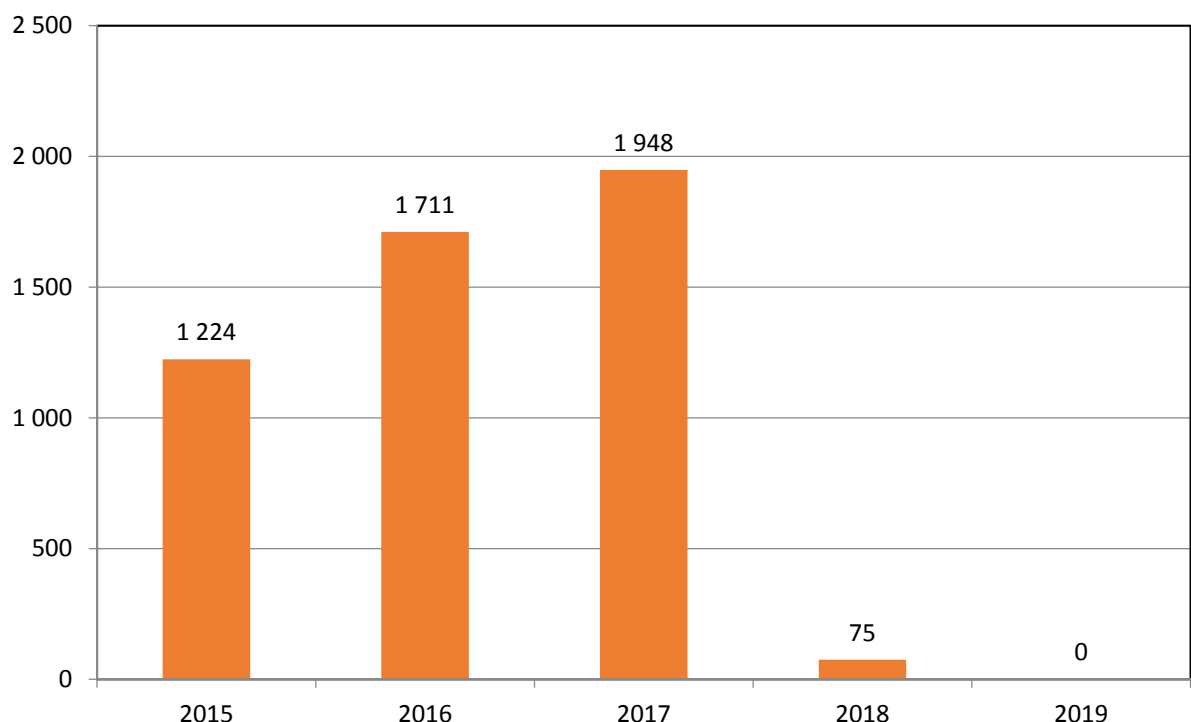


Figure 8 – Dynamics of container traffic on the Dnieper River, units

Source: [22]

Unfortunately, in 2019, no one container was transported along the Dnieper River.

The development of multimodal transportation in Ukraine should take place on the basis of elimination of departmental

and technological fragmentation of railways, ports, road and river transport.

In addition, it is necessary to implement measures for the development of multimodal transport in Ukraine:



- providing state support and economic incentives for the development of multimodal transport;
- implementation of a single position on the formation of the tariff policy of Ukrzaliznytsia and commercial seaports of Ukraine, including the application of a through tariff;
- developing container logistics and improving transport service.

**Conclusions.** In the process of the study, the problems and prospects of multimodal logistics service development in the conditions of digital economy were determined.

1. Based on the analysis of international and Ukrainian legislation, a conclusion was made about the fragmentary and multi-vector nature of existing regulations, which creates organizational, economic and technological barriers to the widespread implementation of multimodal transport with using cleaner modes of transport and the creation of integrated logistics services of cargo delivery on the principles of "Door to Door" and "Just in Time". Using the mechanisms of implementation of European directives and harmonization of existing laws with the requirements of the European Union to reduce emissions, it was substantiated the feasibility of using an ecosystem approach to developing a concept for multimodal transport in Ukraine, which should stimulate market participants to taking part in stimulation innovation and development of transport infrastructure.

2. It is proved that the ecosystem allows to better understand how the logistics service industry is regulated. Its use to create a regulatory and legal framework takes into account the influence of the state and market mechanisms of self-development and self-regulation and increases competence in the field of logistics. The interaction of participants in the multimodal freight transport ecosystem is seen as a horizontal and network environment for communication between all sectors and organizations, provides the creation and diffusion of knowledge flows, transforming these flows into innovation and further spreading of innovations throughout the economy. All these together improve the quality of the integrated multimodal logistics service and the degree of customer satisfaction.

3. Analysis of statistical data on the status and dynamics of multimodal transport in Ukraine allowed to identify disparities between the use of different modes of transport and between export and import freight flows and the low level of intermodality and unification of freight units. That is why the multimodal transport development in Ukraine should be based on the elimination of departmental and technological fragmentation of railways, ports, road and river transport. It was also concluded that the need for state support and economic stimulus for the multimodal transport development, as well as a set of measures for the formation of a network of multimodal terminals, containerization of cargo flows and improvement of multimodal service.

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