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The potential of maritime transport in logistics of Ukrainian grain export

Potencjał transportu morskiego w logistyce eksportu ukraińskiego ziarna

Abstract. The article examines the historical background and logistical characteristics of maritime transport and focuses the attention to its advantages and disadvantages compared to other kinds of transport in the transportation of grain cargoes. It was found that the sea routes exported the majority of grain has considerable potential for the development of port infrastructure and shipbuilding in Ukraine. Old technologies and a significant depreciation of manufacturing equipment are problematic issues of port elevators, which reduce the efficiency of cargo handling. Investment attractiveness of maritime transport confirmed the participation of powerful multinational grain traders in the reconstruction of existing domestic ports and construction of new berths. In recent years the volume and capacity of grain mass transshipment were increased significantly. It is established that the loss of sea ports in temporarily annexed Crimea is not critical for Ukraine logistics grain flow and it caused their temporary reorientation to other ports.

Keywords: logistics, maritime transport, port infrastructure, export, grain.

Synopsis. Niniejszy artykuł w sposób zwięzły przedstawia uwarunkowania historyczne oraz specyfikę transportu morskiego. Mając na uwadze aspekt handlowej wymiany towaru – ziarna – szlakami morskimi, głównym celem opracowania jest przede wszystkim wyróżnienie oraz porównanie wad i zalet transportu morskiego z jego alternatywnymi substytutami. Przeprowadzona analiza badawcza wykazała, iż handel drogą morską jest najczęstszym źródłem transportu ukraińskiego ziarna, a samą Ukrainę cechuje znaczny potencjał w rozwoju infrastruktury portowej i okrętownictwa. Co więcej, bazując na rankingu portowych elewatorów na Ukrainie, potwierdzono, iż w ciągu ostatnich lat możliwość przeładunkowa masy zbożowej znacząco wzrosła. Niemniej jednak, dostrzeżono problem w ich nieprawidłowej eksploatacji m.in. poprzez stosowanie przestarzałej technologii czy znaczny stopień zużycia podstawowego wyposażenia, czego wynikiem jest obniżenie jakości oraz opóźnienia w przeładunkach omawianego towaru. Dodatkowo, wykazano, iż utrata portów z racji rosyjskiej aneksji Krymu spowodowała tylko tymczasowo-

wą zmianę sprawności systemu logistycznego w przewozach ukraińskiego ziarna. Pomimo wymienionych niedogodności, ukraiński transport morski jest obszarem o wysokiej atrakcyjności inwestycyjnej.

Słowa kluczowe: logistyka, transport morski, infrastruktura portowa, eksport, ziarno.

Introduction

Grain food in agribusiness complex is one of the most large-scaled industrial units, which determine international specialization in production of grain in Ukraine. In the past marketing year, our country produced 63.9 million tons of grain [Ukraine... 2014], about 33 million tons of which were exported. It indicates the priority of the grain industry in the formation of export potential and updates the research in this area. The scale grain exports are stable source of foreign exchange to the state budget but it is necessary to adopt appropriate rules that allow Ukraine to fully integrate into the global grain market. To realize the potential export opportunities we must ensure the efficient movement of product flow to potential customers that actualize the role of the transport component in the logistics system.

The globalization of the world economy actualizes the role of logistics as a communication tool to realize the benefits of international division of labor, diversification of markets for multinationals access to cheaper natural resources, despite their distance from the place of consumption etc. Some of logistics activities are the main source of the budget, due to the fact that their territory has an advantageous geographical location. An example would be Panama or Singapore that have altered from poor second-rate countries to powerful ones. Analyzing Ukraine's geographical location, it can be stated that in addition to agricultural production and IT sector, transport could also become one of the three pillars of sustainable growth of the Ukrainian economy. However, this requires significant investment resources to bring Ukrainian transportation system to EU standards.

Theoretical and methodological foundations of logistics activities are the subject of study in foreign works written by D.J. Bowersox and D.J. Kloss, M. R. Lindersa as well as the following Ukrainian scientists B. Krykavskýy, N. Chukhrai who have generalized and adapted the international experience to local realities, created the theoretical foundation for the enrichment and development of logistics concept management decisions. Extensive research into the problems of agrarian economy and grain production in Ukraine were made by V. Andriychuk, V. Boyko, O. Shpychak, V. Yurchyshyn and others. However, these studies do not always take into account the current state of socioeconomic and political processes in Ukraine, as well as the potential of transport component of logistics systems, including maritime transport that ensures grain export flow options which have significantly increased nowadays.

Grain mass transporting are provided by railway road, sea and river transport. Ukraine has favorable geographical and historical conditions and potential for the development of maritime transport as its southern territory is washed by the Black and the Azov seas. They are virtually frozen and have a link with the Mediterranean Sea through the Bosphorus, the Sea of Marmara and the Dardanelles. The total length of the marine shoreline of Ukraine

is more than 2000 km. Regular sea freight through the Black and the Azov seas began in XVIII century. Today they provide 91.2% of export shipments of Ukrainian grain compared to other kinds of transport.

The purpose and methodology of the study

The aim of the article is to develop measures for the efficient use of maritime transport potential in logistics grain export flows. Criterion of decision-making, evaluation of logistics complex advantages and disadvantages in the maritime transport as well as analysis of the use of ships and port infrastructure in the formation of Ukraine grain export flows were the priority of the research. For the solution of these tasks we use the general and special scientific methods of research, namely methods of system analysis, system-logical analysis, statistical, graphic, as well as of comparison, of absolute, relative and middle indexes calculation. The received data are presented in tabular and graphical form. Method of dialectical cognition of objective reality as well as conceptual principles from the papers of domestic and foreign scientists on questions examined in this article are used as the theoretical-methodological basis of research. Certain aspects of research were done on the basis of monographic method.

The main results of the study

The transport component of logistics system ensures the movement of material flow using logistics chains. Criterion choice of vehicle takes into consideration the following factors:

- distance of goods transportation;
- required delivery time, which is a key parameter of proper logistic systems functioning;
- technically possible frequency of cargo shipments in terms of discrete grain flows in the logistics system;
- territorial accessibility for delivery using the appropriate transport determined by the relevant transport infrastructure;
- cost of transportation.

Transport logistics system component is present at all stages of grain flow moving using logistics chains. During the implementation, grain is transported with the help of grain transportation machinery. But after grain processing and changing its physical condition, it requires the use the adapted vehicles.

Due to its significant proportion in the structure of logistics costs, managing the movements of goods becomes actual and is one of the main components of transport value in agrarian business. On grain transportation market a positive trend is observed. It indicates a considerable production potential of agribusiness in general and logistics in particular. Nowadays corn holds 19% in the structure of cargo transshipment in Ukraine. A characteristic feature is the tendency of reorientation of grain freight traffic from road to railway. Tangible of grain transportation machinery shortage and the problem of access to this park cars on the railroad, forces the traders to form its own fleet.

The availability of modern vehicles without proper effective schemes of operation will not give the desired effect. In transport logistics distinguish unimodal, multimodal and intermodal transportation schemes.

If during the whole way of transportation we use only one type of vehicle, it is unimodal transport system. The lack of cargo handling significantly reduces transportation costs, but in large geographical distances relative costs are growing and it complicates the opportunity to carry the goods vehicle due to the nature of transport infrastructure. Intercontinental transport of grain without involving the automobile and (or) railway and maritime transport is impossible, because in a globalized world economic role updated multi- and intermodal transport.

Multimodal transportation system provides using a combination of multiple modes of transportation in the market of domestic transportation and intermodal freight delivery systems involves in combination, where the transfer of cargo transshipment occurs without the owner.

Favorable geopolitical position of the territory of Ukraine sets it as a potential provider of transportation services in the system of international labor distribution. Table 1 demonstrates positive net balance of export-import transportation services, but the potential of Ukraine can be much better exploited.

Using transport, port and elevator infrastructure, Ukraine is able to make global logistic tasks in organization of international grain flows. It will attract international investment resources to development of logistic infrastructure, as well as favor considerable budget revenues by means of large-scale grain market.

Table 1. Structure of export-import transportation services in Ukraine in 2014

Tabela 1. Struktura eksportowo-importowych usług transportowych na Ukrainie w 2014 r.

Kind of transportation services	Export		Import	
	mln USD	share in total amount (%)	mln USD	share in total amount (%)
Transportation services, total	6101.9	100.0	1376.6	100.0
services of sea-going vessels	850.9	13.9	243.7	17.7
services of inland transport	46.3	0.8	1.1	0.1
services of air traffic	1071.3	17.6	431.0	31.3
services of railway transport	1098.8	18.0	431.3	31.3
services of motor transport	459.6	7.5	189.8	13.8
services of pipeline transport	2207.9	36.2	52.6	3.8
other additional and optional services	367.1	6.0	27.1	2.0

Source: Ukraine in Figures [2014].

In logistic chain, which supplies movement of grain flows, considerable attention should be paid to structural support of the system of grain storage. It is an integral component of logistic process, which determines nominal capacity of the logistic system, because implementation of productive potential in Ukraine's grain production (at the level of 100–120 mln ton in a year) is prevented by insufficient parameters of grain-storing capacities.

In 2015 Ukraine had 760 certified elevator storage enterprises with total capacity to store 31,5 mln ton of grain [Cherevko et al. 2016]. Most of the enterprises are concentrated in southeastern regions, i.e. Dnipropetrovsk, Donetsk, Kharkiv, Poltava, as well as Mykolajiv and Odesa regions. Port transfer of grain abroad can explain concentration of elevator capacities in the last two regions. In other regions, where modern elevator storing complexes of silo type were built, considerable capacity was secured by the policy of manual distribution of investment costs of state budget to the regions, represented by the very managers of the budget during the whole period of Ukraine independence. Only in the last two years before the conflict in the East of Ukraine, annual growth of grain-storing capacity made about 2 mln ton.

The total daily capacity of certified elevators is respectively 31.3 and 30.4 thousand, thousand tons per day that supplied the centralized storage of ships and barges, and shipment of grain for ships 11.7 and 4.7 times for barges higher than the power of acceptance [Kolodiychuk 2015]. Port transshipment facilities in Ukraine are focused on grain exports, which explains the formed relationship between the nominal amount of the receipt and shipment of grain flows on water transport.

The advantages in logistics characteristics of sea transport for the grain cargoes carriage in our opinion [Kolodiychuk 2015] are the following:

- the possibility of intercontinental connections;
- high capacity grain flow;
- low cost of transportation of grain mass units;
- unified organizational and technological conditions for container shipment of grain;
- single legal and legal right of the 400-year history.

The disadvantages can include:

- depending on the geography, weather and navigation conditions;
- the unavailability of many of Ukraine berths for ships of class Panamax (displacement 60–80 thousand tons), Handymax (40–60 thousand tons), Handysize (10–40 thousand tons), and the more Capesize (150 thousand tons)
- additional logistics costs for the use of multi- and inter modal transport schemes grain;
- limited the extensive development of port infrastructure and substantial capital intensity measures for its intensification;
- discrete low grain flow across long distances and a limited number of linear and tramp vessels;
- low speed and time spent handling grain.

Problematic issues of domestic port elevators are old technology and a significant depreciation of manufacturing equipment, which reduces the efficiency of cargo handling. The main functions of port elevators are forming consignment of grain with subsequent loading of the vessel and prompt processing of documents. After sending the ship elevator equipment should be ready for the next batch of grain accumulation. Technological operations of the port elevator is identical with the technology of linear elevator, as evidenced by the community following operations: analysis of the grain, its weight, providing technological unity freight elevator process for unloading grain from rail cars of various types (including hoppers) and cars. Common port operations and linear elevators are also cleaning, drying, silo or floor storage units. The only difference between them is the grain shipment which provides significantly more equipment for the storage of grain.

Considering relations between port and line silo, we would like to pay attention to some discussed moments, happening in expert environment. To optimize performance of port elevators [<http://latifundist.com/blog>], it is proposed to make preparation of commercial grain by line silo but not port elevator. It means that grain, which is moved to port elevator, should be ready for loading to a ship, and its preparation should be made by line silo, located in 1–2 hour railway distance from the port terminal. The researcher [<http://latifundist.com/blog>] argues his position by the fact that value of land in port and in “free field” greatly differs. Thus, extensive way to increase parameters of the system of storing and handling of grain should be fulfilled by building of line grain siloes. Being in a system connection with port elevators, they can perform functions of grain preparation, as well supply operative discharge of it by introduction of appropriate calculated capacities to receive raw materials in the period of the highest seasonal load. The proposals also expect that equipment of port elevator should just include two or thousand tons three large (30 thousand tons each) storing containers as well as necessary capacity to take grain from wagons, load it to a ship and nothing more.

Keeping to one of the fundamentals of logistics concept, which proves reasonability to make decisions on the base of technical-economic argumentation of alternative variants, we cannot support or object efficiency of the proposed scheme. However, the following conditions are obvious ones:

- organizational-legal combination of line and port elevators requires coordination of the forms of ownership, sources of investment resources, etc. We note, that main grain terminals are in state ownership and organizationally belong to different state structures, but state financing of new elevators building is not actual nowadays;
- additional handling of grain in the system of “field – line silo – port elevator” means additional expenses and losses of both monetary resources (including transaction expenses) and physical weight of grain.

We do not aim to support or object efficiency of the proposed scheme, because have not made technical-economic argumentation of alternative variants, but just wish to attract attention to intensive measures of port elevators development. Depreciation of equipment requires its renovation, and complex approach to triple task “organization – technology – equipment” enables, in our opinion, achievement of a new level of quality in performance of port elevators within the existing territorial boundaries.

We also pay attention to the reasonability to secure technological integrity of transportation-storing process under performance of one elevator or their combination. Under conditions of diversification of supply sources and directions of shipment of grain, it should combine opportunities of materials handling of different kinds of transport. Reconstruction of the elevators should be made with consideration of individual conditions of transport connection and putting into operation of appropriate technological equipment to secure transportation-storing handling of materials. Priority should be given to vertical silo containers, providing higher intensity of grain shipment in contrast to the enterprises, using floor technology of grain storage. In Ukraine, correlation between tower and floor containers for grain storage makes 46 to 54%.

The historical structure of the port in recent years is undergoing significant qualitative and quantitative changes as powerful grain traders invested a lot of funds in the reconstruction of existing ports and building new berths.

Powerful multinational grain traders like “Cargil, Glencore, Alfred C. Toepfer International” has got great interest in Ukrainian grain market. For the Ukrainian business positive side in cooperation with them is the following:

- access to large credit funds;
- access to world commodity exchanges;
- years of trading experience in the global market with the appropriate legal, logistics and other support infrastructure (port elevators, merchant navy, etc.);
- experience of exporting large quantities of grain (40 thousand tons) which requires a complex system of management decisions and clarity of their execution.

Entering the Ukrainian market, these multinational companies are able to attract significant financial resources, marked by intensive construction of grain transshipment complexes, particularly in Reni, Berdyansk, Kherson, Illichevsk, Odessa Sea trading port.

The main volume of grain cargoes in the world trade is carried by cargo ships class “Panamax” (displacement 60–80 thousand tons), “Handymax” (40–60 thousand tons) and “Handysize” (10–40 thousand tons). Transportation vehicles “Handymax” and “Handysize” class are less profitable because of the freight price. Therefore, leading traders prefer to export grain vessels of “Panamax”, and recently “Capesize” (150 thousand tons). In turn, loading grain in vessels of this type we must make ports that have the appropriate length of the pier (not less than 200 m) and bottom depth (at least 11 m). These parameters correspond to only sea port “Yuzhny” (TIS-Grain) – 14 m depth, Odessa sea port (Ukrelevatorprom (“A.TopferInt.” ADM) – 11 m, Illichivsk seaport (Trans Balk Terminal Kernel) – 11,5 m, Nikolaev seaport (Nibulon) – 12.5 m and Avlita, Sevastopol – 14 m. All other ports have berth depth of 7 to 9 m, which certainly make logistics service much more expensive.

Nowadays in Ukraine there are 66 terminals for handling grain totaling 37.890.000 tons. Logically a record harvest of Ukrainian grain in the 2013–2014 caused high export. The seaports increased grain shipments to 5 million tons per month [<http://www.agrotimes.net>]. For Ukrainian farmers it was the most difficult year in the history of independence. Despite all the social, political, economic and climatic difficulties Ukraine has exported about 33 million tons of grain, which was an absolute record. The previous record export shipments of grain through the ports were recorded in the 2008–2009 marketing year at 23.5 million tons.

During the first six months of 2014, Ukraine increased grain processing in ports to 60.5%. Compared to the 2013, the second quarter of 2014 grain export in the state has been increased by 89.4%. The traditional markets for grain production from Ukraine are Europe, the North Africa, the Middle East and China (joined this season). Overall, a fifth of the total supplied of Ukrainian grain to foreign markets, including the ports of Ukraine (Fig. 1), came to Asia.

Analyzing the structure of transshipment of grain for the first half of 2014 we can see that the leadership in this field are Seaport “Yuzhny” (26% of total transshipment of grain), Odessa and Nikolaev ports, the volume of transshipment of which accounted for 20% (see. Fig.1). Smaller but powerful enough (15% volumes of grain) is Illichivsk seaport with “Glencore” grain terminal and Terminal Trans Balk (“Kernel”).

A characteristic feature of the 2013–2014 marketing year in the shipment of grain was a record volume of grain in containers, amounting to a record 190 thousand tons

to 66 thousand tons in 2012–2013 and exceeded the previous record of 2008–2009. In 2013–2014 the share of large-MR fleet in grain exports from Ukraine increased to a record 49% compared with less than 10% in 2007–2008. It was the largest party of grain shipped volume of 93 thousand tons per vessel. The share of light-duty fleet in export reduced, despite the development of river transport.

In recent years container shipping has become quite popular in the world. It is a method of using twenty-foot grain containers as it is the worldwide unit of measurement of the capacity of freight vehicles. In the US grain exports in containers has grown by 29% over the past four years, and this way, in our opinion, has great prospects for development in Ukraine as well.

The advantages of container grain handling are full control of its quality, efficiency and delivery schedule shipments. It reduces loss of load, the ability to send small lots of grain and reduce logistics costs. To confirm introduce comprehensive comparison of rates when sending grain, which according to calculations [http://www.agrotimes.net] for the implementation of the scheme “wagon load in the elevator – delivery to the port – reloading a container” in 2013 amounted to 53 USD per tone in the case of option “boot car on the elevator – delivery to the port – loading a container” – 51.5 USD. USD per tone, while under the “supply of empty containers for loading the elevator rail – load on the elevator – the return of loaded containers at the port” – only 48.1 USD. USD per tone and the losses of grain cargo amounted to 0.5%.

In 2013, port container handling in the export of Ukrainian grain amounted to only 10% of the total, although the dynamics are positive. For example, the first quarter of

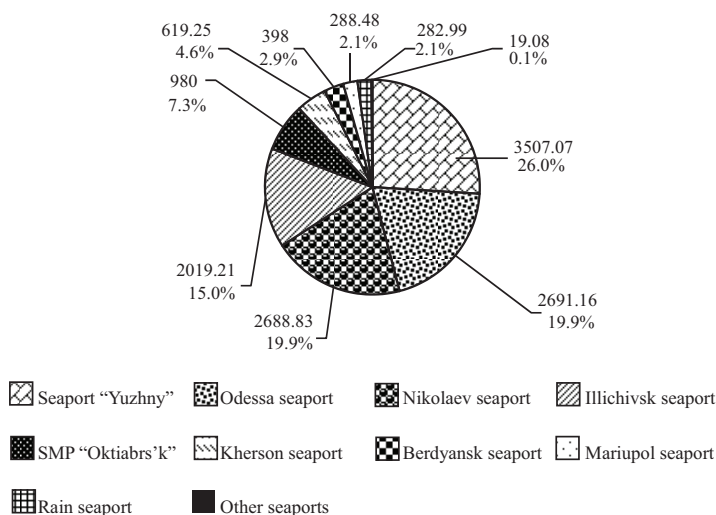


Figure. 1. Structure of transshipment of grain cargoes by seaports of Ukraine in the first half of 2014, thousand tons (%)

Rysunek. 1. Struktura przeładunku ziarna portami Ukrainy w pierwszej połowie 2014 r. w tys. ton (%)

Source: the dates from the reports of enterprises.

2013 was prevalent 4995 containers with grain in 1102 against the first quarter of 2012 [<http://www.agrotimes.net>]. That is in four times. In particular, through the port of Odessa quarterly volume of grain handling in containers increased from 669 to 4293 units, and Illichivsk port – from 433 to 702. Significant prospects of containers can be seen also in road and river transport of grain.

All existing in Ukraine terminals for grain transshipment according to their leadership rating (2013–2014) are presented in Table 2.

As we can see from the Table 2 temporarily annexed Crimea ports provide handling about 5% of the national volume of grain, 4% of which was accounted for Avlita (Sevastopol). It is not critical for Ukrainian logistics and can cause temporary reorientation to other ports.

Table 2. Rating of Ukraine port terminals on grain exports in 2013–2014 MR

Tabela 2. Ranking ukraińskich terminalów portowych, eksportujących ziarno w latach 2013–2014 RM

No rating	Port / terminal / trader	Volume, thousand t	%
I	Sea port „Southern” TIS-Grain	6293	16,6
II	Nikolaev seaport NIBULON	4541	12,0
III	Odessa seaport Olimpex Coupe	2670	7,0
IV	Illichivsk sea port grain terminal Glencore	2540	6,7
V	Odessa seaport Ukrelevatorprom (A. Toepfer Int. (ADM)	2347	6,2
VI	Nikolaev seaport Nika-Tera	2210	5,8
VII	Nikolaev seaport Hrintur-Ex (Bunge)	2171	5,7
VIII	Illichivsk seaport terminal Trans Balk (Kernel)	2169	5,7
IX	Sea Port „Yuzhny” Borivazh	1970	5,2
X	Avlita, Sevastopol	1500	4,0
XI	Odessa seaport, port elevators (State Food and Grain Corporation Ukraine	1000	2,6
	55 Other terminals (marinas)	8389	22,2
	Total	37800	100

Source: [<http://latifundist.com>].

Today an ongoing modernization of such old port elevators as Odessa and Nikolaev will increase grain elevator capacity by 35% in Nikolaev, while in Odessa port elevator the modernization measures will increase its transshipment capacity of 3 million tons per year.

According to the plan of modernization, Illichivsk port is planning to increase handling grain capacity for almost 12 million tons, Yuzhny – 21 million tons, Odessa – 5 mln tons. In addition, the investment projects of Odessa port have already implemented in the near future to increase port capacity of grain cargoes to 10–12 million tons [Grain...

2014]. It should be noted that the construction of a grain terminal “Brooklyn” on the pier Androsovsk will increase capacity of 4 million tons. The first phase of 11 containers for storage of 72.4 thousand tons of grain was designed in 2013. By the way, European Bank for Reconstruction and Development, according to [<http://universal-trade.in.ua>], is planning to allocate stevedoring company¹ “Brooklyn-Kyiv” loan of \$ 60 mln USD USA. The project of terminal construction is implemented together with *Louis Dreyfus Commodities*, one of the leading commodity traders in the world. Total project cost is 103.8 million UAH.

Recently, the capacity for storing grain in Nikolaev seaport on the terminal “Nika-Tera” was increased from 40 to 210 thous tons, which enabled the company to double the 2013–2014 marketing year volumes of grain. Positive developments were also seen in Ochakov port where in spring 2014 a new grain terminal with a total capacity of 250 thous tons was put into operation. It provided the transshipment for export of 11.8 thousand tons of grain in the 2013–2014 marketing year [<http://universal-trade.in.ua>].

Conclusions

Thus, to evaluate the potential of maritime transport and port infrastructure of Ukraine analysis suggests considerable reserve of sea transport to ensure export shipments of grain cargoes. This port shipment is power-oriented in Ukraine grain exports as grain shipping capacity to water transport in 11.7 times for ships and barges to 4.7 times higher than the capacity of its acceptance.

In the structure of grain transshipment in the first half of 2014 is notably seen a leadership of Seaport “Yuzhny” (26% of total transshipment of grain), Odessa and Nikolaev ports, and transshipment volumes of each accounted for 20%. Somewhat smaller, but powerful enough in volumes of grain (15%) provides Illichivsk seaport, which are *Glencore* grain terminal and Terminal Trans Balk (*Kernel*). These ports are leaders in the administration of grain abroad and therefore top most powerful marine terminals Ukraine. Loss of sea ports temporarily annexed Crimea is not critical for Ukraine and logistics grainstreams it caused their temporary reorientation to other ports.

For efficient use of maritime transport in logistics of Ukraine export grain flows, it is necessary to intensify activities towards qualitative and quantitative renewal of port infrastructure. In Ukraine today there are 66 terminals for transshipment of grain mass totaling 37.89 million tons, but ambitious strategic program is to increase annual production volumes of grain in Ukraine to 90–100 million tons and therefore double its exports potential. For technical and technological modernization of port elevators and for the deepening of port berths to serve relevant vehicles that provide the bulk of the transportation of grain cargoes in world trade, important to further cooperation with powerful multinational grain traders that are interested in Ukrainian grain market and invest in its

¹ Port operators (stevedoring company) – an entity that carries out the operation of the terminal, makes handling, storage cargo ships and passengers, as well as other related economic activities [On seaports... 2012]

development. Besides promising prospect of logistics integration is container transportation of grain by sea. Despite the economic and political difficulties in Ukraine, marine logistics infrastructure of grain demonstrates qualitative and quantitative changes. In our view, the fundamental trend lays in the foundation for structural changes in the economy of Ukraine, which will facilitate its prospective integration into the European Union. It is very important not retreat from the outlined goals but demonstrate and implement state legislative and financial support.

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