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## The principle of the extended responsibility in the formation of multimodal transportation attractiveness

**Abstract.** It has been proved that the principle implementation of the enhanced liability in the activity of the industrial enterprises of Ukraine covers its implementation in the supply chain that protects the manufacturer's responsibility for the entire product life cycle. It has been justified that one of the ways to increase responsibility of supply chain is to use multimodal transportation, which provides an effective combination of multiple transport types, optimises the delivery time, reduces storage costs, the total cost of transportation and provides a reduction of the amount of harmful emissions into the air. It has been proved that the internalisation of environmental costs in the final cost of the product or service reduces the negative impact on the environment and promotes the use of environmentally friendlier modes of transport in the supply chains. In the second half of 2015 the authors conducted an online survey among service managers of 30 transportation services enterprises. The survey showed that 45±3% of the respondents provide transportation outside Ukraine; only 30±2.5% give priority to compliance with European emission standards, while 40±3% of the respondents consider it necessary to develop the market of multimodal transportation in Ukraine.

**Keywords:** Principle of Responsibility; Multimodal Transportation; EU Standards; Externalisation; Internalisation; Environmental costs

**JEL Classification:** M3; L87

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### **Принцип розширеної відповідальності у формуванні привабливості мультимодальних перевезень**

**Анотація.** У статті доведено, що впровадження принципу розширеної відповідальності в діяльність промислових підприємств України передбачає імплементацію його в ланцюг поставок, що забезпечує відповідальність виробника за весь життєвий цикл продукту. Обґрунтовано, що одним із напрямів підвищення відповідальності ланцюга поставок є використання мультимодальних перевезень, які забезпечують ефективно поєднання декількох видів транспорту, оптимізують час поставки, знижують складські витрати, загальні витрати транспортування та забезпечують скорочення шкідливих викидів у повітря. Доведено, що інтерналізація екологічних витрат у кінцеву вартість продукту або послуги, дозволить зменшити негативний вплив на довкілля. З метою аналізу ринку вантажних перевезень автотранспортом України нами було проведено Інтернет-опитування головних менеджерів відділів роботи з клієнтами 30 підприємств-надавачів транспортних послуг. З'ясовано, що перевезення поза межами України здійснюють 45±3% з опитаних підприємств; тільки 30±2,5% надають пріоритет критерію «Відповідність транспортного парку європейським стандартам екологічності», а 40±3% респондентів вважають необхідним розвиток в Україні ринку мультимодальних перевезень

**Ключові слова:** принцип відповідальності; мультимодальні перевезення; стандарти ЄС; екстерналізація; інтерналізація; екологічні витрати.

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### **Принцип расширенной ответственности в формировании привлекательности мультимодальных перевозок**

**Аннотация.** В статье доказано, что внедрение принципа расширенной ответственности в деятельность промышленных предприятий Украины предусматривает имплементацию его в цепь поставок с целью обеспечить ответственность производителя за весь жизненный цикл продукта. Обосновано, что одним из направлений повышения ответственности цепи поставок является использование мультимодальных перевозок, которые обеспечивают эффективное сочетание нескольких видов транспорта, оптимизируют время поставки, снижают складские расходы, общие затраты на транспортировку и обеспечивают сокращение вредных выбросов в атмосферу. Доказано, что интернализация экологических издержек в конечную стоимость продукта или услуги позволит уменьшить негативное влияние на окружающую среду. С целью анализа рынка грузовых перевозок автотранспортом Украины нами был проведен Интернет-опрос главных менеджеров отделов по работе с клиентами 30 предприятий-поставщиков транспортных услуг. Установлено, что перевозки за пределами Украины осуществляют 45±3% опрошенных предприятий; только для 30±2,5% приоритетом является критерий «Соответствие транспортного парка европейским стандартам экологичности», а 40±3% респондентов считают необходимым развитие в Украине рынка мультимодальных перевозок

**Ключевые слова:** принцип ответственности; мультимодальные перевозки; стандарты ЕС; экстернализация; интернализация; экологические расходы.

### 1. Introduction and Brief Literature Review

The 2015 United Nations Climate Change Conference, which was held in Paris in December 2015, adopted an international agreement, the provisions of which are aimed at easing the pressure on the ecosystem and which should replace the 1997 Kyoto Protocol after its expiry date in 2020. The importance of this document lies in the fact that since 1850 the temperature on the planet Earth has grown by 1 degree on average, and carbon emissions have increased by 30% since the period of industrial revolution in the mid-19th century. Arctic ice has been reducing by 4% every decade since 1979. Also, there have been nine of 10 the hottest years since 2000 [16].

In Ukraine, the Ministry of Environment and Natural Resources has clearly defined the priority of the implementation of ecological provisions in the field of air protection, which envisages the creation of a European system of environmental pollution monitoring [7]. The top priority task for industrial enterprises is to make active «the polluter pays» principle, which makes the producer responsible for the entire life cycle of products. This also regards the supply chains. Integration of the national transport infrastructure into the global infrastructure, especially into the European transportation system, updates the formation of responsible supply chains, which is one of the solutions concerning the reduction of the negative impact on the environment.

The introduction of the principle of extended responsibility of the producer in the field of engineering activities aimed at the prevention of environmental pollution not only at the stage of production but also at the stages of delivery of the necessary raw materials and final products marketing. With the Euro 4 standard adopted in Ukraine in 2014 [14], which regulates the content of harmful substances in the exhaust gases of vehicles, producers are developing scenarios of environmental damage reimbursement. Therefore, enterprises producing goods and services aim to improve their supply chains because the cost of transportation grows, which, in its turn, requires to include a new component of expenses related to the provision of ecological standards of transportation [5]. With the formation of responsible supply chains, the manufacturer should give preference to cooperation with the logistics company that cares about the environment and ensures the necessary level of environmentally friendly transportation reducing the share of road traffic and using fuels of a higher quality. In order to improve its competitiveness at the transport market, a logistics company should consider the benefits of multimodal transportation, which provides an efficient combination of several types of transport, optimises the transit time, reduces storage costs and the total cost of transportation, leads to a reduction of carbon emissions into the air, etc.

Ukraine has enormous problems with the environment pollution that actualises the introduction of the principle of extended producer responsibility (EPR), a new strategy in the field of environmental protection which is aimed at the reduction of the environmental impact of a product through the producer's responsibility for the consequences of the negative impact caused by production, and also binding commitments concerning collection, recycling and disposal of the product to its manufacturer [10]. Means of transport that emit more than 39% of the total amount of air pollutants in Ukraine are also taken into consideration with regard to emissions from road transport that comprise 91% [1]. Currently, the legal framework of taxation of vehicles does not consider the indicators which are of direct relevance to the level of emissions of pollutants. Thus, adequate measures are not taken to stimulate the use of more environmentally friendly technologies from the part of carriers.

The analysis conducted by the National Institute for Strategic Studies [3] indicates a decrease in Ukraine's transit potential and the possibility of Ukraine's exclusion from the global market of multinational transportation. Public Joint Stock Company «Ukrainian Railway», which is the basis of transit potential of Ukraine lost 70.5 million tonnes of the annual volume of transit goods in 2014, if compared to 2007. However, the country's transport infrastructure allows transporting over 110 million tons of transit cargo by rail, inland waterway and road transport

each year. Nevertheless, the actual volumes of transit are only 41 million tons or less than 40% (excluding pipelines).

Currently, a new draft of law «On Railway Transport», which includes the market liberalization of rail transportation, changes in tariff system aimed at the improvement of the investment attractiveness of the sector and an increase in its competitiveness, is being developed in Ukraine. PJSC «Ukrainian Railway» started its activity on 1 December 2015. It was created to separate the functions of the state and the business. The functions of public administration are assigned to the Railway Transport Agency, while the National Commission for Regulation in the Transport Sector (NCTR) is responsible for setting tariffs, and PJSC «Ukrainian Railway» will perform the business function. A transitional structure based on the functional principle will operate at the first stage of reforming. Hence, there should be only one joint stock company with the departments fulfilling several work directions. During the second stage in the period of 2016-2017, there will be a full separation of responsibilities and authorities according to the key areas of work. The formation of the ultimate structure of PJSC «Ukrainian Railway» should be completed in 2020.

With regard to international multimodal transportation [14], the share of container and combined transportation is insignificant, which is primarily affected by the imperfect regulatory legislation of Ukraine, nomenclature of goods that are not always subject to containerisation, high risks of multimodal transportation, the lack of a developed network of transport and logistics centres, etc. Even in the Transport Strategy of Ukraine till 2020 [9], the development of multimodal transportation is not provided properly. A positive phenomenon in this area is the development of the necessary mechanisms by the Ministry of Infrastructure of Ukraine [8] related to the development of container traffic in the direction of China - Kazakhstan - Azerbaijan - Ukraine - Georgia - EU, which involves additional volumes of transit through the territory of the country, the increase in financial revenues to the Ukrainian railways, ports and ferries.

During the meeting of representatives of Ukraine and Italy in Rome [13] in July 2015, they agreed on the quota of permits for international freight traffic in 2016. Ukraine's application of multimodal transportation, namely connections with European countries through the combined transport solutions, such as railways, highways or sea routes, will allow the countries to develop a better transport system [13].

**2. The purpose** of the article is to analyse development prospects of the multimodal transport market in Ukraine and introduce the principle of responsibility in this field.

### 3. Results

Consumption models could not be effective without externalisation of costs, namely reimbursement of costs of manufacturers or service providers by other institutions. The hidden costs may include the costs for pollution, diseases of population, construction of roads, bridges, parking lots, gas stations; maintenance of traffic lights and traffic control systems, the cost for reconstruction of buildings and monuments damaged due to smog; the fight with noise and creation of sound-absorbing barriers, support for emergency services, congestion (estimated more than 1% of GDP), treatment of persons with accident-related traumas (financial losses of the state make up approximately 7% of GDP in 2014) [19]. In order to compensate these costs, the price of energy should be increased by 20-60% [20]. As for the transportation, the user pays only 25% of the actual costs (fuel, including taxes and excise taxes; insurance; maintenance).

Thus, the externalisation of ecological costs arising in the production process and consumption of goods leads to the economic choices that really are not economically viable. When taxpayers (the funding of environmental protection is carried out by the state) or future generations (cleaning the polluted environment, getting substitutes of non-renewable resources, improving of the functioning of the ecosystem due to the loss of biodiversity) pay costs for the environment, it not only does not allow an efficient use of natural resources but also creates excess demand, because goods are sold at low prices due to incorrect allocation. Therefore, internalisation of environmental costs in the final cost of a product or service, which pertains directly to the government of the State, will

improve the country's ecology, make the producer use natural resources carefully, improve production technology, and use environmentally friendly vehicles in the supply chains. It goes without saying that some activities will reduce the competitive level of carriers and, perhaps, will never be involved.

According to the indicator for competitiveness [4, 34], with an increase in the rate of freight tariffs, road transport has come out on top in Ukraine. This explains why it is so common, especially at a distance of 500 km. Transport tariffs of freight traffic by automobile transport include primarily compensation of operating costs, financing of investments, reimbursement to the state budget of funds for staff training, health and education which are not included in the cost of transportation, formation of economic incentive funds (fund of financial incentive, fund of social development, etc.); payments from the state budget for the basic production assets, normalised working capital, human resources, received bank loans [11], not to mention the environmental costs in the system of tariffs.

In the Association Agreement between Ukraine and the EU, it is said about the introduction of European standards and norms in Ukraine in the field of environmental protection, involving the implementation of 20 acts of European legislation [7]. These decisions will have a positive impact on Ukraine's output in the European freight market regarding the use of multimodal transportation, such as transportation of standardized loading units (containers, swap bodies, semi-trailers adapted to vertical processing) by different modes of transport (railway cars, ships or trucks) through at least two countries on the basis of a single transport document, where the responsibility for the execution of the contract of transportation belongs to the multimodal transportation operator.

In the case of multi-modal transportation, it will be possible to improve environmental aspect of transportation by reducing the share of road transport. In addition, certificates permitting road transportation in the EU will be require a compliance of certain characteristics of vehicles to the EU standards with regard to the quality of fuel use by them.

For example, the General Inspectorate of Road Transport (GITD) has been operating in Poland since 2001. Its mission is to control traffic law enforcement, eliminate any negative phenomena in the area of transport and to implement the principles of environmental protection [18]. Only in 2014, the GITD of Poland issued 4,427 permits for cargo transportation in the country to Ukrainian carriers, and the total number of issued certificates for international carriage of goods by road for their own needs was 7,474, compared to 15,787 previously issued permits [17]. The GITD issues also environmental permits for cargo transportation (Table 1) with regard to the use of high-quality fuel.

Tab. 1: Number of vehicles that are divided into types of environmental permits in the area of freight transportation in Poland in 2014

Type of the transport	EURO0	EURO1	EURO2	EURO3	EURO4	EURO5	EURO6	Total
Freight / %	868 / 0.51	1 542 / 0.91	9 030 / 5.35	43 596 / 25.85	25 824 / 15.31	79 515 / 47.15	8 270 / 4.90	168 645 / 100

Source: [17]

As an example, we consider the results of the comparative analysis of the two transportation models: using only transportation by road and multimodal transportation using vehicles and rail transport [19].

Hence, the Container Transport System of Russia - Warsaw is a multimodal transportation system. It works according to such a scheme: a container terminal as a point of consolidation - railway - container terminal as a point of deconsolidation and radial trucking system in Poland with the providing of supplies on a «door to door» principle. Models are analyzed in terms of cost, time, transportation, risk of cargo damage and environmental factors of influence on the environment, which has led to a conclusion that multimodal transportation increases the efficiency of the supply chain. Firstly, even without the additional discounts

offered during the transportation by carriers, transport costs for multimodal transportation are smaller than for transportation by road. Secondly the transportation time is two times less. Thirdly, goods that cross the border of the two countries are better protected against damage. Fourthly, the analysis of the rules suggests that multimodal transportation is more environmentally friendly.

In the study of costs for transportation with the use of the 20-foot container by road or rail, reflected in [12, 475], it has been proved that the cost for rail transportation, even taking into account the costs associated with loading and unloading of the container is lower, which is shown in Figure 1.

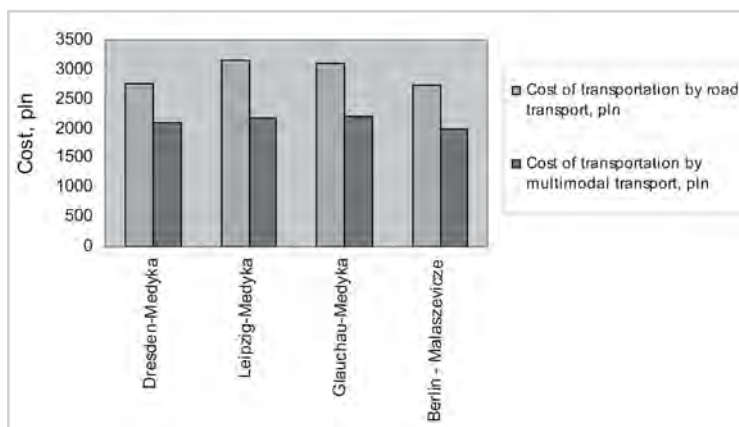


Fig. 1: The cost of transportation by road and multimodal transport Source: [12, 145]

Regarding temporal characteristics, the duration of transportation by road is lower on the analysed routes and varies from 3 to 4.4 hours. [12, 475].

In Poland, the multimodal transportation business has been consistently developing for several years and is believed to be highly profitable.

The company known as PKP Cargo, which was established in the 2000s as a result of restructuring and privatisation of part of the Polish State Railways and entered the Warsaw Stock Exchange in 2013, is another example. January through June 2014, the company increased its net profit by 67% to 128 million PLN compared to the same period in 2013 and became a leader in the Polish market in the segment of carriage of goods by rail [2]. In the first quarter of 2015, the company decided to increase intermodal transportation (more than 16%) believing that container transportation is the most promising segment of the transportation market by rail. In addition, the company has been investing both in infrastructure and rolling stock, having established a network of intermodal transportation from the East to the West and from the North to the South. By purchasing 80% of shares of Advanced World Transport (AWT), one of the largest Czech freight

carriers by rail in Europe, and by signing a strategic agreement with the national carrier of Croatia, which is HZ Cargo, the company gained access to the new markets, European terminals and sea ports in southern Europe. The access to Paskov container terminal, which is located near the border of Poland and Slovakia and is close to the industrial areas of Poland and the Czech Republic, is especially important for PKP CARGO. On the other hand, due to its mutual activity with the Croatian company, RKP CARGO has got quick access to modernised ports and a cargo terminal with a relatively dense network of railways, which allowed the company to increase the volume of multimodal traffic in the north-south direction.

Today, the PKP CARGO Group owns five active container terminals in Poland and one in the Czech Republic. In the first



half of 2015, PKP CARGO issued several contracts with three Chinese carriers on integrated logistics services and multimodal transportation from China to Germany and the Netherlands, which excels Ukraine and is competitive to transport giants like Deutsche Bahn. As part of the 2016-2020 strategy, PKP CARGO has identified targets for its leadership in the market of intermodal operators in Central and Eastern Europe. Nowadays, the largest Polish transportation carrier is focusing on the development of international transport services and is going to provide within the entire supply chain. PKP CARGO will invest in the sector of multimodal services which, in their opinion, is the most promising segment of the transport market. Furthermore, PKP CARGO plans to offer transportation by road at the final stage of the supply chain.

To analyze the market of freight transportation by road in Ukraine, a survey of 30 companies providing transportation services both in Ukraine and in European countries was conducted. In the second half of 2015, the authors conducted an online survey which was carried out among customer service managers of 30 enterprises from all regions of Ukraine providing transportation services not only in Ukraine but also in European countries to analyze the market of cargo transportation of the Ukrainian road transport.

The sample is representative for the given probability  $P = 0.9$ , which corresponds to the table-valued  $t$ -test equal to 1.645, the coefficient of variation features -  $V_x = 0.33$  and the level of inaccuracy of survey results -  $V_{\Delta} = 0.1$ .

The statistical analysis of the survey results by the known methods [5] with a probability of 95% helped to identify the following features of the general totality of freight traffic carriers by automobile transport in Ukraine:

- 1) transportation outside Ukraine is done by  $45 \pm 3\%$  of the surveyed enterprises;
- 2) ranking in terms of the importance criteria shows that only  $30 \pm 2.5\%$  of respondents give priority to compliance with European emission standards;
- 3)  $80 \pm 2\%$  of the respondents were ranked high by the criterion of established partnerships with clients;
- 4) the proposal of logistics products adapted to individual customer needs was reported by  $60 \pm 3\%$  of the respondents;

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