

## **INTRODUCE EXPANSION OF THE TRANSPORT ACTIVITIES OF RAILWAY COMPETITIVE ENVIRONMENT**

Currently, the main task of railway companies is to maintain and, if possible, expand the competitive position in the market of container and piece cargo by wagon shipments. The rapid transition of Western countries to a historically new post-industrial stage of development in the second half of the twentieth century, characterized by the restructuring of their economies in the direction of rapid growth in the share of small and medium-sized businesses, which, in turn, fundamentally changed the requirements of cargo owners to the organization and quality of transport services. In these conditions, the railway industry is experiencing ever-increasing competitive pressure from road transport in the segment of container and piece cargo.

In our opinion, the further development of transport companies and strengthening their competitiveness due to new sources of financial resources achieved under the conditions of significant expansion of their sphere of activity, entry into new segments of the transport market on the basis of creation of non-traditional (hybrid) transport systems, radical reconstruction and re-profiling of inactive roads and significant expansion of commercial and service functions of structural subdivisions. To substantiate this concept, it is advisable to look more deeply at the causes of structural changes in the world economy over the past half century and their implications for the transport sector of developed countries, to which Ukraine seeks to join.

It is known that the main and extremely urgent problem of further stable functioning of domestic railway transport in the market of transport services is the radical improvement of the financial and economic condition of the industry. It is no secret that its fixed assets are used at the limit of their capabilities, and, above all, this applies to their most important group – rolling stock, depreciation of which reached 90 %. Solving the problem of obtaining additional financial resources requires a comprehensive approach, one of the directions of which is to find ways to diversify the activities of the railway industry. This is due to changes in the economy of Ukraine after the collapse of the USSR, which are associated with the emergence of crises, reduced production, the formation of new cooperative ties between economic entities, changes in priorities in export – import policy, reorientation of producers to other markets, etc. and, as a

consequence, the reduction of rail traffic and the length of routes. the priority of the railway was the transportation of mass, mostly raw materials over long distances. However, the rapid transition of Western countries to a historically new post-industrial stage of development was characterized by the restructuring of their economies in the direction of rapid growth of small and medium-sized businesses, which, in turn, fundamentally changed the requirements of cargo owners to organize and quality transport services. In view, obtaining new sources of financial resources can be achieved by significantly expanding the scope of logistics activities of PJSC "Ukrzaliznytsia", its entry into new segments of the transport market through the creation of non-traditional (hybrid) transport systems, radical reconstruction and redevelopment of inactive routes and essential connections. commercial and service functions of its structural subdivisions. To substantiate this concept, it is advisable to consider in more depth the causes of structural changes in the world economy over the past half century and their consequences for the transport sector of developed countries, to which Ukraine seeks to join.

*PART I. Historical Background of Structural Changes  
in Western Economies*

The unification of the major oil-producing countries of the Middle East in 1960 into a cartel called the Organization of the Petroleum Exporting Countries (OPEC) provided these countries with a monopoly opportunity. control the world oil market and influence its situation. This allowed them to impose an embargo on oil supplies to industrialized Western countries in 1973 in response to their support for Israel in the Arab-Israeli military conflict, which immediately led to a sharp doubling of oil prices (from \$ 16 to \$ 37 per barrel). ) (*Prosvirin, 2010* ). The consequence of these processes was the global energy crisis, which later turned into an economic crisis that affected all industrialized countries.

Production technologies, which were used in those years in the basic industries and in the machine – building complex of these countries, were energy – and material – consuming in nature given the low energy prices in the previous period. The unwillingness of the existing technical and technological base of industrial production of economically developed countries to work in the face of unexpected increases in energy prices has led to a general rise in prices in all sectors of the economy, reduced demand and reduced output, deteriorating purchasing power. countries were forced to make strategic decisions about the need for rapid restructuring of their economic systems, which fully covered the transport industry. The main emphasis was on the development of energy-saving technologies. The

implementation of the energy saving program has allowed Western countries to reduce the energy intensity of the industrial complex by 1.5–2 times within 5–10 years. Thus, by 1986, oil consumption per unit of gross domestic product (GDP) in the United States fell by almost 35 %, and in Japan – twice. This led to further GDP growth without a significant increase in the material resources used. Production of basic industries (mining, energy, metallurgy) has not increased, and in some cases decreased, which, in turn, stopped further growth in rail transport of bulk resources. This was largely due to the integration of intellectual and scientific and technical potential of the G7 countries in the period 1975–1977. This forced oil-producing countries to reduce oil prices from \$ 37 to \$ 15 by 1986. per barrel (*Osmova, 2018*) and caused a reduction in annual oil production by OPEC countries by 17.5 % (*Kolesov, 2018*).

A qualitative leap in the development of energy-saving technologies led to the rapid overcoming of the negative effects of the global energy crisis of the 70's and led to radical changes in the transport complex of economically developed countries of the West.

#### *PART II. Narrowing the scope of Western rail freight transport in the post-crisis period*

Structural changes in Western economies in the post-crisis period were reflected in the reorientation of industry to the production of high-tech products with low resource consumption, thus ensuring dynamic GDP growth without a significant increase in resources, respectively, the volume of rail traffic. Analysis of the work of railway transport of twelve economically developed countries showed that by 2000 for every 1 % of GDP growth, rail freight grew by an average of only 0.04 % (*Zorina, 2010*).

The protectionist policy of the Western leadership in the field of venture capital firms has ensured a constant increase in the production of science-intensive products, a sharp and comprehensive development of small and medium-sized businesses. Already at the beginning of the XXI century, the volume of production in the sphere of small and medium business of these countries reached 60 % of GDP. Transportation of such products, as a rule, is carried out in small volumes in the shortest possible time. This condition is best met by road transport and a well-developed road infrastructure. At the same time, the share of rail transport is the transportation of bulk cargo of limited range, which are produced by enterprises of basic industries and agriculture. This has led to a decrease in the volume of rail freight, and in some cases to a reduction of the railway network (*Pogasiy, 2010*).

Similar trends are characteristic of Ukrainian railway transport. Most small and medium-sized shipments are provided by road, despite the extremely unsatisfactory condition of the road surface. The railway mainly transports bulk raw materials, while the volume of such transportation decreases from year to year due to reduced demand for basic industries both in the domestic market and due to the unstable situation of Ukrainian raw materials abroad (*Zhelezova, 2016*). At present, the vast majority of artificial and container transportation through the territory of Ukraine is carried out by cars. Even large enterprises of the machine-building complex, which produce technically complex products for agricultural purposes, extractive industries, etc., as well as their customers, as a result of reduced production, are increasingly using road transport.

The motivating factor for cargo owners to give preference to the use of road transport is the short time of the cargo on the road without overloading it with a high degree of safety, which ultimately provides business structures to reduce working capital and accelerate their turnover. Every year, the competitive pressure on rail transport from road carriers is growing and this trend is constantly growing. There is no doubt that the future implementation of a large-scale state program of overhaul and restoration of the Ukrainian road network, rapid progress in the automotive industry will inevitably accelerate this process. Based on this, it should be recognized that the outdated technical and technological base of Ukrainian railway transport significantly hinders the organizational development of the industry and, as a consequence, causes great complexity of the transportation process. All this does not give grounds for optimistic hopes for significant qualitative changes in improving the financial condition of the railway industry in the coming years. It is known that the laws of dialectics, according to which the national transport and transportation market develop, cannot be changed, but they can and should be taken into account when determining the strategy of economic activity, quickly and flexibly formed in anticipation of changes in market conditions. The mechanism of such a response was discovered by the founders of economic thought A. Smith, D. Ricardo [2, p. 34, 69] and K. Marx in the process of studying their objective law of market economy – the law of the tendency of the rate of return to decline. This mechanism is manifested in the rapid movement of capital from low-income industries to high-profit industries. In addition, it is worth mentioning one of the most important principles that guide the business community in Japan, namely – you can defeat them, unite with them" (*Tatsuno Sh, 2015*).

The authors propose four universal vectors for expanding the transport market segment based on the diversification of the Ukrainian

railway company – Public Joint Stock Company "Ukrzaliznytsia" (PJSC "Ukrzaliznytsia") and can be considered as ways to further diversify services provided by railway companies in different countries.

*PART III. Four vectors of expansion of transport services  
by railway companies*

In our opinion, obtaining new sources of financial resources by railway companies can be achieved by significantly expanding and diversifying the scope of their logistics activities, entering new segments of the transport market by creating non-traditional (hybrid) transport systems, radical reconstruction and re-profiling of inactive roads and significant expansion of commercial and service functions of their structural units. This requires a comprehensive approach and, in our opinion, in the near future it is advisable to focus on the following areas:

1. The use of rail trolleybuses with a combined traction system for accelerated trunk and local transportation of container and piece cargo.
2. Use of electric trains with variable number of sections and combined engine system, which will provide the possibility of transporting container and piece cargo at passenger speed on main and local lines, as well as their autonomous movement on non-electrified access tracks.
3. Reconstruction of inactive railway sections into highways for servicing small freight flows by non-rail vehicles of the railway company.
4. Creation of regional transport and supply clusters on the basis of the railway company, which should ensure the supply, storage and sale of material and technical resources to economic entities

*PART IV. The use of electric trains for accelerated freight transportation  
by small consignments*

The priority and long-term problem of the Ukrainian railway is extremely insufficient funding for the development of the industry. The defining reasons for this are that over the last eleven years the volume of freight traffic has decreased by 27 % [1], revenues from long-distance passenger transportation cover their cost by an average of less than 40 %, and the cost of suburban rail transportation is eight times higher than revenue from this service [2].

Outdated technical and technological base hinders the organizational development of the industry and, as a consequence, causes great complexity of the transportation process. All this does not give grounds for optimistic hopes for significant qualitative changes in the improvement of the financial condition of the railway industry in the coming years.

Spoil, in small batches with passenger speed and minimal overload, ie on a door-to-door basis. For this purpose, there are the necessary (and, perhaps, sufficient) organizational and technical capabilities of an infrastructural nature and the appropriate domestic rolling stock capable of performing such transportation.

Or alternating current EP9 of all modifications, and also trains EKr1, development of the Kryukovsky car-building plant in the conditions of their sectional use. Motor cars of electric trains of the ER type are equipped with four electric motors with a total capacity of 960 kW [3, 5], capable of developing a maximum speed of up to 130 km / h. One section of such a train can transport either one 20-ton container with a load of not more than 17 tons, or piece cargo weighing not more than 17 tons gross. The design of wheelchairs allows to make turns, with a radius of 150 m, under the condition of movement with a speed no more than 10 km / h. This makes it possible to use sections of electric trains on the access tracks of enterprises. An indisputable advantage of electric trains for freight transportation is the ability to equip them with batteries, which allows them to move on non-electrified access tracks. (weighing 40 tons and with a capacity of 806.4 kA \* h, the mileage of sections can reach 150–190 km) [4]. At the same time, the batteries will be constantly charged when electric trains pass through the main lines.

All these advantages are inherent in electric trains manufactured by PJSC "Kryukiv Carriage Plant". The cars of these trains have a load-bearing beam and are able to withstand a load of 20 tons.

Table 2.8.1

### Characteristics of electric trains

Parameter	ER2	ER2T	EKr1
Construction speed, km / h	130	130	220
Electric braking	no	yes	yes
Occasion	impulse	impulse	impulse
Power system	Direct current	Direct current	Двосистемный

Re-equipment of Soviet-made electric trains and production of electric freight trains at PJSC "Kryukiv Carriage Plant" should be carried out in the form of open platforms – for transportation of containers, covered cars – for transportation of piece goods and refrigerated cars. Adaptation of passenger electric trains for transportation of goods by small consignments requires some design changes, namely, the transfer of the current collector within the main car, increasing the size of the driver's cab by equipping

vestibules to provide comfortable working conditions for the train crew. However, such design changes do not require significant capital costs, and the cost of manufacturing freight electric trains will be much lower compared to passenger counterparts due to the lack of passenger cabin. The optimal composition of such a train – one – two sections (2-4 cars). This will reduce the downtime of trains under loading and unloading operations, the waiting time for train formation at departure stations and avoid the need to process trains at intermediate stations and, thus, promptly deliver goods to their destination on a certain route.

At present, there is a significant reserve of railway infrastructure capacity, which allows you to seamlessly allocate schedule threads for the organization of such transportation. It should be noted that the possible reduction in the number of electric trains for suburban passenger traffic should be offset by the introduction of suburban bus routes, which will be provided by PJSC "Ukrzaliznytsia". This will reduce financial losses from suburban rail transport, increase industry revenues and, as a result, significantly improve the competitiveness of the railway in the market segment of container and piece cargo. In addition, the organization of such a transport system will have positive national consequences of both purely economic and environmental nature, namely, first, it will restrain the use of heavy vehicles, which is the main cause of the destruction of Ukrainian roads; secondly, it will reduce harmful emissions into the atmosphere of diesel combustion products.

#### *PART V. Researches and their results*

At the initiative of scientists of the Ukrainian State University of Railway Transport (UkrDUZT) preliminary researches of possibility and expediency of realization of projects in set of the specified directions of expansion of transport services by the Ukrainian railway company (PJSC "Ukrzaliznytsia").

1 It can be argued that the practical implementation of works in accordance with the first direction (hybrid type trolleybus with a combined traction system of engines) does not cause serious technical and technological difficulties. To confirm this, it should be noted that: first, there is extensive world and domestic experience in the production of freight trolleybuses at the Kremenchug Automobile Plant and Kyiv Electric Transport Plant (KZE), and passenger trolleybuses were manufactured at YuMZ (Dnipro), KZE, Lviv Bus Plant ( LAZ), Bogdan Motors car assembly plant № 1 (Lutsk); secondly, the world's longest trolleybus line Simferopol – Yalta (96 km) was built in Ukraine and has been successfully operating in difficult mountainous conditions for fifty-eight years; thirdly, currently the

production of freight trolleybuses and truck tractors on their basis is organized by Scania, Mercedes-Bens, the maximum speed of which reaches 90 km / h, and in Sweden the road is electrified for their operation.

Assessing the relevance and prospects of the organization of freight interregional trolleybus transportation, a study of the technical feasibility and economic feasibility of organizing the transportation of containers and piece cargo by freight trolleybuses on a door-to-door basis on the route Odessa – Kiev in both directions. due to the economic relations of the city of Odessa and Kiev. Odessa is a window of import to Ukraine, here is the largest port in the country, where containers with goods come by sea. Kyiv is the capital of Ukraine and the business center of the country, where the largest trade enterprises and their central offices are located. Besides, the key factor is that the Odessa – Kiev highway is most suitable for the organization of freight trolleybus transportations now.

2. In accordance with the second direction of expansion of transport services, the real way to increase the volume of rail freight container, piece goods and perishable goods, small batches with passenger speed and minimum congestion, ie the principle of "door to door" is the use of sectional electric trains. To do this, there are the necessary (and possibly sufficient) organizational and technical capabilities of an infrastructural nature and the appropriate domestic rolling stock capable of performing such transportation.

The requirements for accelerated delivery of the above goods are met by electric trains of Soviet production of direct current type EP2, EP2R, and alternating current EP9 of all modifications, as well as trains EKr1, developed by Kryukovsky Carriage Plant, in terms of their sectional operation. It should be noted that of the 350 trains used for suburban transportation in the work fleet is about 30 %. Motor cars of electric trains of the ER type are equipped with four electric motors with a total power of 960 kW, capable of developing a maximum speed of up to 130 km / h. One car of such a train can transport either one 20 – foot container with a load of not more than 17 tons, or piece cargo weighing not more than 20 tons gross. The design of wheelchairs allows to make turns, with a radius of 100 m, under the condition of movement with a speed no more than 10 km / h. This makes it possible to use sections of electric trains on the access tracks of enterprises. An indisputable advantage of electric trains for freight transportation is the ability to equip them with batteries, which allows them to move non-electrified access tracks at low speeds (15–20 km / h) to a maximum distance of several kilometers. For this purpose it is enough to use modern rechargeable batteries, the weight of which does not exceed 1 ton per car. At the same time, the rechargeable batteries will be constantly

charged when passing electric trains on the main lines. Alternatively, if necessary, they can be equipped with auxiliary diesel engines, which are equipped with diesel trains or railcars. All these advantages are inherent in electric trains produced by PJSC "Kryukiv Carriage Plant". Carriages of electric trains of Soviet and Ukrainian production have pivot beams and are able to withstand loads up to 20 tons.

Re-equipment of Soviet-made electric trains and production of electric freight trains at PJSC "Kryukiv Carriage Plant" should be carried out in the form of open platforms – for transportation of containers, covered cars – for transportation of piece goods and refrigerated cars. Adaptation of passenger electric trains for transportation of goods by small consignments requires some design changes, namely, the transfer of the current collector to the front of the main car, increasing the size of the driver's cab by equipping vestibules to create comfortable working conditions for the train crew. However, such design changes do not require significant capital costs, and the cost of manufacturing freight electric trains will be much lower compared to passenger counterparts due to the lack of passenger cabin. The optimal composition of such a train – one – two sections (2–4 cars). This will reduce the downtime of trains during loading and unloading operations, the waiting time for train formation at departure stations and avoid the need to process trains at intermediate stations and, thus, promptly deliver goods to their destination on a certain route.

At present, there is a significant reserve of infrastructure capacity on the Ukrainian Railways, which allows to allocate threads of schedules for the organization of such transportation without hindrance. It should be noted that the possible reduction in the number of electric trains for suburban passenger traffic should be offset by the introduction of suburban bus routes that can be provided by the railway transport company. This will reduce the financial costs of suburban passenger rail transport [9], increase the industry's revenues and, as a result, significantly improve the competitiveness of the railway in the market segment of container and piece cargo. In addition, the organization of such a transport system will have positive national consequences of both purely economic and environmental nature, namely, first, it will restrain the use of heavy vehicles, which is the main cause of the destruction of roads; secondly, it will reduce harmful emissions into the atmosphere of diesel fuel combustion products.

3. In accordance with the third direction of diversification of the transport company (reconstruction of inactive railway sections into highways) the possibility of building a highway on the basis of inactive railway section Chernomorsk – Odessa with access to the highway Odessa –

Kiev for transportation of containers and artificial cargo by road, belonging to.

Reconstruction of the specified section envisages dismantling of the track-sleeper lattice with all technical means, and on its basis will be built 7.5-meter-wide highway, with all engineering structures, suitable for heavy-duty vehicles, mainly freight trolleybuses, which will be connected to the Odessa-Kyiv road. The results of preliminary technical and economic calculations from the project implementation are characterized by the following data: costs for the reconstruction of the site and the introduction of the system "freight trolleybus" – about 130 million UAH are expected; projected volume of container traffic per year – 6600 units; economic effect from transportation for 10 years, taking into account the reduction to the last year of cash flows is expected to amount to about 390 million UAH. Calculations show that the reconstruction of the inactive section and the use of freight trolleybuses is at least 1.5 times more profitable compared to the current operating conditions of the railway.

4. In accordance with the fourth direction (creation of regional transport – supply clusters as part of the transport company), it is proposed to organize on the basis of the transport company regional transport and supply clusters, which will create conditions for expanding their business, ensuring the following logistics functions: {{ 1}} – supply of material and technical resources in accordance with the orders of economic entities of the region,

– creation of warehouses for wholesale trade in material and technical resources and organization of their delivery to consumers; building materials, household goods, agricultural production and processing,

– organization of delivery to the customer of products produced in the region (at the request of the manufacturer or customer).

In order to implement this project it is advisable to use the experience of logistics cluster in the Kharkiv region hyons (Ukraine). For this purpose, in 2013, by the decision of the Kharkiv Regional State Administration, a working group was established, based on scientists of UkrDUZT and specialists of the Southern Railway. In the course of work foreign and domestic experience of creation of regional cluster associations is investigated, program documents of the organization in Kharkiv region of regional transport – logistic cluster are developed and approved by the management of regional administration, namely, "Strategy of development of regional transport system on the basis of formation – transport – logistic cluster". also "The main provisions and tasks of the Program of formation and development of the transport and logistics cluster in the Kharkiv region". The main provisions of the above organizational and

methodological materials were recommended for use as a model in the creation of transport and logistics clusters in other regions of Ukraine.

Of course, the conducted research is of a conceptual nature and requires more in-depth consideration and appropriate feasibility study. However, the obtained preliminary results allow us to draw an optimistic conclusion about the possibility and feasibility of practical implementation of these areas of diversification of the transport company, which will give impetus to the transformation of railway companies into powerful national multidisciplinary logistics concern holding type with a high degree of competitiveness. In addition, the above proposals may attract foreign investors who will be interested in obtaining appropriate financial results.

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