

The distribution of economic profit between logistics system participants while transporting cargo by road and rail

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Abstract – Existing approaches of choosing the transport mode in the logistics system have disadvantages. Firstly, they do not allow to determine the advisability of using transport modes taking implicit costs into account. Secondly, the requirements of the logistics system are not taken into account, including transportation reliability, immobilization, etc.

The authors suggest to view economic profit as a performance criterion taking into account implicit benefits and costs of the logistics system that affect the decision of transport mode choice. The laws between logistics system participants' economic profit and distance using the road and rail transport in Ukraine were determined.

Key words – Transportation, logistics system, economic profit, road transport, rail transport, distance.

I. Introduction

The absence of effective interaction between different transport modes for cargo transportation has a negative impact on the logistics systems development and increases the transportation cost and time. There is a large range of interchangeability between road and rail. Global trends of these transportation modes confirm the need for an integrated approach to the transport choice. The issue of interchangeability between road and rail delivery systems, particularly for shipments in refrigerator containers is an important one for Ukraine. Thus, there is a necessity for scientific justification of rational use considering the requirements put forward by the consigner, consignee or logistics system in general and current logistics principles.

II. Research

Assuming the fact that the analysis of areas using appropriate modes relative to the cargo type has been conducted for a long time, it is a necessary to develop this question in the current economic conditions. The analysis of the freight market on the cargo type transported by road and rail, suggests a reversal of the assertions of the appropriate use of rail transport for bulk cargo and road transport for perishable goods.

As a result of interviews with experts, the most important factors that influence the transport mode choice in the main cargo transportation were identified: distance, transportation costs, amount of cargo, cargo preservation and timely transportation. [1] Thus, it is appropriate to identify areas of efficient use of road and rail for specific groups of goods. [2]

The indicators of the system economic output are the main criteria of the logistics system functioning. [3] This study involves the consideration of a logistics system

without changes to infrastructure, so the presence of the investment component has been excluded. Thus it is inappropriate to use the following criteria: net present value (NPV). The logistics system economic profit is proposed as a performance criterion instead.

Economic profit is the total revenue of an enterprise, which excludes all economic costs, including explicit and implicit costs. Using economic profit as a criterion of efficiency of logistics system in choosing the transport mode will take into account the implicit benefits and costs of logistics system that affect the decision as to the transport mode choice.

The objective function of the researched system is characterised by the following formula:

$$EP_{sys} = EP_{vidpr} + EP_{trans} + EP_{oder} + x \quad (1)$$

$$\Omega : x^+ \leq x \leq x^{++} \quad (2)$$

Where EP_{sys} is logistics system economic profit, cu;

EP_{vidpr} is consigner economic profit, cu; EP_{trans} is

transport participant economic profit, cu; EP_{oder} is

consignee economic profit, cu; x means technological

and economic parameters of the logistics system for transporting cargo by road and rail.

The basic technological and economic logistics system parameters are: the amount of cargo by road and rail; industrial power handling mechanisms at consigner's and consignee's storage facilities; the cost of 1 ton of cargo; distance; road and rail transport fares; time for the formation of orders by road and rail; coefficient taking into account the share of actually received cargo transported by road and rail respectively; the transport of cargo, waiting time, waiting time while being loaded with cargo anywhere between the point of departure (railway station) and the final destination (consignee).

The most used criterion in practice of transport mode is the transportation distance, so let us use this criterion.

As a result of mathematical simulation, the model enables us to construct histograms of distribution of economic profit between logistics system participants for cargo transportation by road and rail in Ukraine with rail sidings of consigner and consignee, depending on the transportation distance, Figs. 1, 2 and 3.

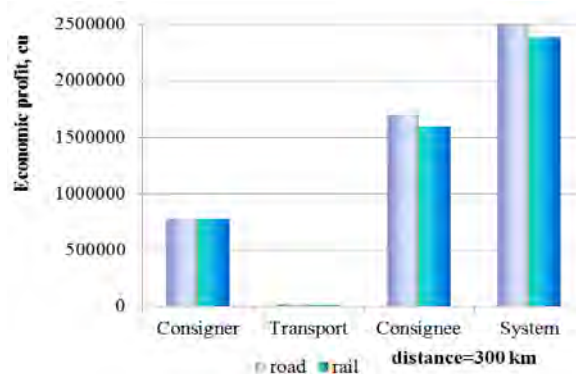


Fig.1. Histogram of distribution of economic profit between logistics system participants for transporting cargo by road and rail in Ukraine, distance 300 km

Analysis of the results leads us to the following conclusions. When shipping cargo to a distance of 300 km, the use of road transport is a rational choice for the logistics system from the standpoint of the chosen criterion, and the economic profit of the system is 2497256 cu, Fig. 1.

The use of road transport to the consignee and transport participant, that directly provides transportation services in the system, is also advantageous under these conditions. The increased profit is 104503 cu to the consignee, and 7600 cu – for transport participant.

However, if the distance is increased to 1500 km, the choice of transportation mode may change (Fig. 2).

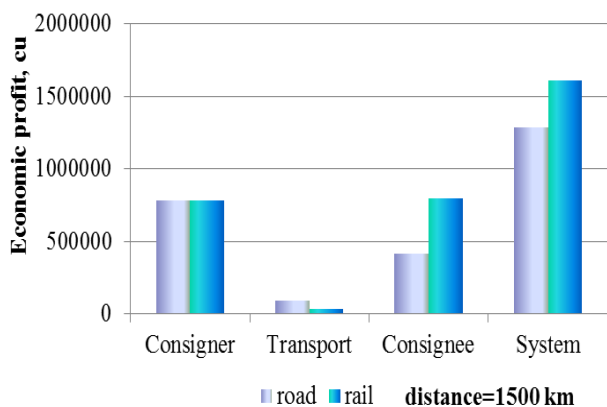


Fig. 2. Histogram of distribution of economic profit between logistics system participants for transporting cargo by road and rail in Ukraine, distance 1500 km

Advantage under these conditions is given to railway transport for consignee and logistics system as a whole. Logistics system economic profit using rail transport is 1609824 cu, consignee economic profit is 799334 cu. To remain profitable for road transport cargo in the logistics system, the economic profit under these conditions should equal 94500 cu.

Given that the transportation distance is 2100 km difference in economic profit by road and rail increases transport participant, consignee and logistics system as a whole, Fig. 3. Transport participant economic profit using transport road transport is 89343 cu. The use of road transport is not advisable for the consignee there is a loss of economic profit.

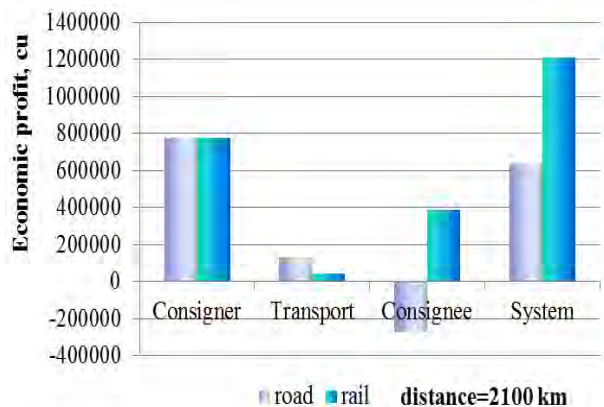


Fig.3 Histogram of distribution of economic profit between logistics system participants for transporting cargo by road and rail in Ukraine, distance 2100 km

Logistics system is appropriate for the use of rail for distance of 2100 km in Ukraine, while economic profit difference is 574252 cu. For consigner economic profit is the same when using road and rail regardless of the distance.

Conclusion

The research revealed the laws between economic profit logistics system participants and the system in general and the distance.

Firstly, using the efficiency of logistics system as a criterion while choosing the transport mode allows to take into account the economic profit management costs that can significantly influence the transport mode choice.

Secondly, as distance increases, the logistics system economic profit and consignee economic profit decrease. This is explained by the fact that in the model the value of the cargo is considered a constant. With increasing distance transport participant economic profit increases with the use of road transport. The consignee is the only party unaffected by the distance.

In further studies, it is possible to determine the equivalent distance of transportation for each logistics system participant and for the system on the whole, based on the criterion of economic profit, however, this time management costs might be taken into account.

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