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COMPARISON OF INTERMODAL AND COMODAL TRANSPORT

Road transport has a negative impact on the natural environment. It causes not only environmental degradation, but also contributes to accidents and time loss resulting from the crowds on the roads and in cities. These are so-called external costs. Therefore, there should be more environmentally-friendly industry branches such as rail transport, inland or inshore navigation. The conception, thanks to which the external costs can be decreased is intermodal transport. In recent years it has appeared as an idea of the carriage of goods which takes into account not only the protection of the environment but also the economic and organizational aspects. It is co-modal transport.

1. INTRODUCTION

The issue of transport, costs of transport, transport influence of on the environment, the choice of the right means of transport has been lately widely discussed and considered. In recent years the transport policy has considered to a high degree the harm of transport on the environment, especially road transport. The considerations were based upon the external costs. Therefore, there were preferred types of transport being more environmentally-friendly such as rail transport, inland and inshore navigation.

The idea, thanks to which the external costs can be decreased in the loading transport is intermodal transport. It consists of combining the rail, road and vessel transport which unburdens the crowded roads and makes the carriage more efficient. The important issue is the choice of the carriage mode of transport as well as the stock.

Intermodality, however, was not good for logistics and economic purposes of the transport, shipping or logistic companies functioning on the competitive market. The effect of the discussion concerning these issues is the statement that goods transport should be balanced, that it should take into consideration the rules of the protection of natural environment but it also should be economically efficient and use the existing resources optimally².

There is the concept of co-modality which means the efficient use of different modes of transport in the aim of obtaining an optimal and sustainable utilization of resources.

2. REASONS OF INTERMODAL TRANSPORT APPLICATION

A considerable share in logistic costs are transport costs connected with the deliveries of products from suppliers and deliveries of the already-made goods to recipients. Depending on the transport activity the costs of transport are made up of the costs of our own transport service and the external costs of transport-forwarding services.

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² J. Archutowska, *Transport komodalny – nowa koncepcja transportowa Unii Europejskiej*, „Logistyka”, 2009, nr 2.

Taking into consideration how the costs shape one can notice that the fixed costs are prevalent, which is not connected with the amount and the frequency of the freight. Whereas, the exploitation costs (changeable) compared to the load unit are relatively low.

The external costs of transport-forwarding services depend on³:

- distance and time,
- type of freight,
- amount of consignment,
- type of mean of transport and rate of exploitation,
- manipulation works and forwarding activities.

For the total cost account of the customer service it is necessary to include the lost incomes due to the lack of stock and some mistakes in service.

Running short of supplies increases costs connected with⁴:

- the loss of the incomes from the current sales due to the lack of products, delays in deliveries, supplies of the wrong quality, orders withdrawal.
- the decrease of possibility of realization of incomes from sales in the future due to the lack of trust from purchasers and decreasing of the company reputation.

Losses because of inefficiency and mistakes in service are connected with:

- wrong localization of stocks, irrational usage of transport means, costs of delayed, emergency deliveries;
- lack of ability of taking advantage of other forms of capital than supplies, insufficient technical equipment in warehouses, unnecessary points of sale, unused means of transport.

Unit costs are calculated as the costs of one passenger-kilometer and ton-kilometer. It means the average shipping cost of one passenger or one ton of load for the distance of one kilometer. As the share of the fixed costs in the overall costs is relatively high, the unit costs decrease when the production increases.

Part of the transport costs are constant as for the distance, whereas some of them as for the shipping object. Therefore, we can talk about two phenomena⁵:

- distance degression of the unit costs,
- degression of unit costs connected with the size of the shipping object.

It has its reflection in the amount of the tariffs for the transport services. There are two kinds of prices: for the shipping services and for making use of the transport infrastructure. Prices for the shipping services are paid by the transport users, whereas the second type of prices concerns both individual road users or the companies exploiting the vehicles.

The prices of making use of the transport infrastructure are:

- direct payments imposed on the infrastructure users,
- indirect taxes imposed on fuel, energy, tires, etc.,
- other taxes, payments imposed on the infrastructure users.

For the shipping services the contract price or the tariff price can be established. The contract price is the price established during the negotiations between the carrier and the

³ D. Kempny, *Logistyczna obsługa klienta*, PWE Warszawa 2001, s. 47.

⁴ *Ibidem*, s. 48.

⁵ *Kompedium wiedzy o logistyce*, red. E. Golembaska, PWN Warszawa 1999, s. 115.

customer. It is used for non typical shipments and for the seasonal and changeable markets. Whereas, the tariff prices are established by the state, self-government units, carrier associations and they are publicized.

In many value tariffs the loads classification is established, and each load is classified depending on the value and for each class the rate is decided. The forwarding costs depend on the distance and the size of the dispatch. The longer the distance and the bigger the dispatch, the lower the unitary costs. It is the distance degradation of tariffs and depression connected with the size of the dispatch.

Apart from the costs discussed above there are other external costs, very often omitted. These are the costs connected with the degradation of the natural environment, accidents as well as congestion on the roads and in cities.

These costs were estimated in 1995 in seventeen countries in Western Europe. At that time the external costs without the congestion costs were 530bn euro, that is 7,8% of overall GDP of these countries. In 1991 these costs were 272bn euro, thus they rose twice within four years. The costs that most grew were those connected with pollution of the environment and changes in climate (48% of overall external costs). The significant category of these costs are accident costs (29%) and the costs of landscape degradation and excessive urbanization(5%).

Taking into account the kinds of transport, the biggest part of the external costs are due to car transport – 485bn euro (91,5%). The share of air transport is 32,3bn euro (6,1%), rail transport 10,3% (1,9%) and sea transport 2,4bn euro (0,5%)⁶.

A lot of countries draw conclusions from the data. For instance, in some of them the depression of payments is not applied. The amount of road payment is proportional to the distance, load, and to the emissions of fumes. There are plans to include also the costs of building, exploitation and infrastructure as well as measurable part of the external costs which are connected with accidents, air pollution and noise.

All the arguments speak for the development of the rail transport and intermodal transport, which not only improves the goods shipping but also unburdens the congested roads.

3. METHODS OF REALIZATION OF INTERMODAL TRANSPORT

Intermodal shipping is realized by means of at least two transport branches on the basis of one shipping agreement and when there is only one contractor responsible for the whole. There can be container shipping, road-rail shipping or the shipping by means of changeable trailers⁷.

Building is an Indispensable element in the creating and functioning of the mode transport, rebuilding and modernization of the container terminals. The container terminals are a part of the logistic centers whose building may be initiated by rail carriers. PKP CARGO Ltd. has chosen six places for the logistic center. One of them is in Małaszewicze.

⁶ S. Trzaskowski, *Renans kolei*, „Nowe Życie Gospodarcze”, 2003, nr 18.

⁷ *Kompendium wiedzy ...*, op. cit., s. 112.

The container terminal which functions within this Logistic Center consists of the following parts⁸:

- railway track which includes: two wide tracks of 669m of length and two European ones of 778m long
- container area of 4 650 square meters of concrete surface with rainfall disposal to the well where the containers can be stored in two layers at ca. 350 units of UTI,
- two container cranes of various weighing capacity of 37,5 t/40,5 t/45 ton, depending on the equipment
- two-storey administration building.

The choice of equipment and their placement in the container terminal was done on the basis of the accepted system of goods deliveries. The containers are brought from the east on the Russian wagons and after the reloading they are taken west on the European wagons or by means of cars.

The container terminal in Małaszewicze has been adjusted to car transport since 2009. The operations include the railway tracks works, round routes and squares, sanitary installations, telecommunication devices and electro-energetic networks. The terminal is supposed to consist of three reloading and storage places whose overall area will be of 122 thousand of square meters. The investment is realized with the support of the state budget and subsidies⁹.

The Second type of intermodal shipping is rail-road transport in which two techniques are applied:

- shipping of trucks or the sets on the wagons,
- shipping of the semi-trailers on wagons.

Transport is in the wagons of low running gear due to the necessity to abide by the rules as to the height of the wagon and load on it. The „Rollende Landstrasse” system is applied. The train consists of two low level wagons for shipping cars and two passenger ones for drivers. For semi-trailers shipping there are platforms or pocket container wagons used where part of the floor for placing the axle of the semi-trailer and wheels is lowered against the floor where the semi-trailer is placed.

A Changeable body is the car loading boxes without the chassis is separated for the road vehicle and can be carried on the rail wagons. As in the case of the containers they are standardized. The advantage of this solution is the possibility of fast loading without any special terminal investments and relatively low costs of wagon purchasing. However, in this system the costs of exploitation are high as there are frequent surveys required of the wagons, and here is the fast wear of the hoops in the wheels¹⁰.

In many countries there are new wagon constructions and new technologies developed for the rail-road transport. The company Modalohr from France has prepared the type of combined transport “rail-road”, based on the special articulated wagon with the moving aside platform which enables for the self-loading of the semi-trailers or cars from the assembled on the rail loading platforms. The basic advantage of this technology is lower

⁸ H. Zielaskiewicz, I. Nowak, *Możliwości wykorzystania istniejącej infrastruktury PKP S.A. przy tworzeniu centrów logistycznych*, „Logistyka”, 2009, nr 5.

⁹ *Ibidem*.

¹⁰ H. Zielaskiewicz, I. Nowak, *Czym wozić TIR-y po torach*, „Flota. Transport. Logistyka.”, 25 listopada 2009.

financial expenditure to adjust the rail infrastructure due to the classical diameter of wheels. On the other hand the terminal is pricey as well as the purchase of the special wagons¹¹.

Interesting solutions also can be found in Poland. Let's take the company Tabor Szynowy Opole S.A. as an example which built the wagon prototype 602S. It is a low floor wagon with the transient load surface, which is designed for the shipment of trucks with semi-trailers and containers on the lowland routes of a long-distance and transit transport. The side wagons of the train are equipped with bent side buffer beams. The entry on to the wagons and the exit of the cars from it is by means of the movable loading platforms. The length of the wagon together with the bent side buffer beams is 24 400mm and the loading length is 18 260 mm. The height of the loading surface from the main rail is 600mm. The wagon weighs 20,4 tons and can carry 44 tons of load. According to the producer it will be the cheapest model of all these types of wagons available on the market¹².

In Poland intermodal shipping accounts for only 0,2% of the overall forwarding, while in the EU countries it is from 5% to 15% and over 1% of the rail transport (in EU from 15% to 25%). 95% of this shipping is the container transport¹³.

The development perspectives of intermodal transport are promising in Poland. It concerns both the internal shipping but also the transit forwarding as well as replacing the so-far sea transport on the route Asia-Russia-western Europe. However, such steps require significant investment on development and building of routes, railway infrastructure and logistic centers.

4. CO-MODAL TRANSPORT

Companies try to make an order quickly by using mainly road transport. In the European countries the share of the road transport in the overall goods transport is 76,9% whereas in case of the rail transport it is only 17,6%¹⁴.

The effect of such solutions is, in a short term, an improvement of the realized processes and increase in the customer satisfaction, but in the long term one can notice a change for the worse. It is because such more frequent and faster deliveries require the involvement of higher number of transport means which is the cause of the decrease in the congestion and the safety on the roads. The increasing congestion makes the decrease in the average speed of vehicles and the longer time of delivery and increase in the customer dissatisfaction and even loss of orders.

An alternative can be the use of other transport modes, especially the rail transport. Unfortunately, the entrepreneurs are not very often interested in the alternative carriages. Therefore, very significant are the arguments concerning the improvement in the financial results of these companies.

The problem has been noticed by the European Commission which decided to introduce some changes to the transport policy, focusing on the support of rationalization of the transport processes. In the so-called White Paper published in 2006 the notion of

¹¹ H. Zielaskiewicz, I. Nowak, *op. cit.*

¹² H. Zielaskiewicz, I. Nowak, *op. cit.*

¹³ J. Bosakowska, *Na początek jeden procent*, „Gazeta Wyborcza – Logistyka”, 30.09.2003.

¹⁴ M. Hajdul, *Komodalność, czyli efektywna organizacja procesów transportowych*, „Logistyka”, 2009, nr 2.

“co-modality” was used. It means the efficient use of various means of transport in order to make the balanced and optimum as for the economic and financial level of the services use of the resources taking into account the environmental protection¹⁵.

There is no necessity to use transport modes others than the road ones, but all the transport processes should be used in an efficient way. It may mean that for the goods carriage there will be only road transport used. The increase of efficiency concerns only so-far realized concepts and also new solutions such as Modular Concept and Big MAXX.

Modular Concept is the transport of goods with the use of the trailer-truck which consists of the road tractor and two semi-trailers. The maximum length of such a truck is 25,25. All the Scandinavian countries and the Netherlands support this solution. For many years the trailer-trucks have been used to carry the loadings on the territory of these countries and the trade exchange in all Scandinavian Peninsula and also between Finland and Russia¹⁶.

The Big MAXX concept is promoted mainly by the German producers. It is based on the needs of harmonization of the lengths of loading spaces of the articulated, tandem and trailer vehicles by introducing for exploitation the long semi-trailers called Big MAXX¹⁷.

The articulated vehicles and tandem vehicles can carry two changeable bodies, and each of them has a nominal length of 7,45 m, whereas the tractor trailer is too short by 1,3 m. At present on the German roads the longer trailer of 14,92 m is being tested. The length of the whole vehicle is 17,8 m.

Thanks to the increase of the loadings capabilities without the increase of the vehicle length the congestion on the roads is not increasing. Apart from this there should not be an increase in the damage of road infrastructure due to the road loads as the acceptable axle load have been left the same. The higher volume of the goods may cause the decrease in the overall number of carriages and at the same time the decrease in congestion and improvement in road infrastructure.

The test results concerning the realization of the Modular Concept conducted in eight member states of the European Union show that the aims determined by co-modality have been achieved, and by performing the same work the number of road carriages can increase by 32%, and at the same time the costs can decrease by 23%, fuel usage by 15%, CO₂ emission by 15% and the roads exploitation and congestion may decrease by 5%¹⁸.

Both solutions enable to carry at the same time the higher amount of changeable bodies and containers, which allows for the economic efficiency of the intermodal and multimodal carriages, which is the one of the basic aims of co-modality.

5. CONCLUSIONS

The basis of realization of the intermodal transport were mainly ecological conditions. Co-modality refuses such an approach. It does not mean that intermodality and other concepts cannot be applied within co-modal transport.

¹⁵ *Ibidem*.

¹⁶ J. Łacny, *Komodalność jako nowy trend w transporcie ładunków*, „Logistyka”, 2009, nr 2.

¹⁷ *Ibidem*.

¹⁸ M. Hajdul, *op. cit.*

The Transport policy of European Union supports co-modal transport since it makes possible to achieve the balanced use of sources. Whereas, the critics of this policy accuse the European Commission of departing from the policy of the balanced development.

Co-modal transport should consider the advantages of the transport modes, and the way of its realization should take into account all the resources which should be used optimally, that is with considering the economic and financial conditions, the level of the services, as well as taking into account the aspects of environmental protection.

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PORÓWNANIE TRANSPORTU INTERMODALNEGO I KOMODALNEGO

Transport drogowy oddziałuje w negatywny sposób na środowisko naturalne człowieka. Powoduje nie tylko degradację środowiska, ale także przyczynia się do występowania wypadków oraz strat czasu, wynikających z zatłoczenia na drogach i w miastach. Są to tak zwane koszty zewnętrzne. Powinno się więc preferować gałęzie transportu bardziej przyjazne środowisku, takie jak transport kolejowy, żeglugę śródlądową i przybrzeżną. Koncepcją, dzięki której można zmniejszyć koszty zewnętrzne, jest w transporcie ładunków transport intermodalny. W ostatnich latach powstała koncepcja przewozu towarów, która bierze pod uwagę nie tylko ochronę środowiska, ale także uwzględnia aspekty ekonomiczne i organizacyjne. Jest to transport komodalny.