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DETERMINING THE FLOW OF GOODS WITH THE GOAL OF INCREASE OF EFFECTIVENESS IN CARGO TRANSPORTATION IN THE RIVER-SEA DIRECTION

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Abstract:
Important place in the process of increase of effectiveness in cargo transportation by waterways are reserved for direct river-sea transports. This refers to transports between places on inland waterways and sea ports. This is the reason why, in order to improve this means of transport, it is necessary to determine technical and economic factors, which determine suitability of this means of transport. Determining the flow of goods is one of the most important factors.
Serbia is a country with very favourable transport-geographical position considering that the shortest road and rail corridors between countries of Western and Central Europe and Southern Europe and Middle and Far East go through its territory. International waterway Danube flows 558 km through Serbia, connecting the North Sea and the Black Sea through canal Danube-Main. Due to this well-located transport-geographical position international freight transport on pan-European corridors VII and X has been constantly increasing.
The goal of this paper is to determine the total flow of goods for Serbia, as precisely as possible. From this information potential flow of goods on river Danube - sea direction can be set aside.

Key words:
Flow of goods, river ports, sea ports, river-sea vessel.

1. INTRODUCTION

The goal of this research is to display data on transport of goods on our inland waterways. This research provides the data on economic, technical and geographical characteristics of transport and traffic of goods. Additionally, the following indicators are also obtainable: types and carrying capacities of vessels, vessel flags, places of loading and unloading of goods, countries of loading and unloading of goods, types of transport and amounts of transported goods. Moreover, this research offers the data on domestic and international goods flows by ports of loading, unloading, as well as data on vessel flags.

The data from this are used for presenting overall volume and structure of goods traffic on inland waterways, as well as for comparing the goods traffic on inland waterways with the traffic done by other modes of transport. Statistic of inland waterways transport enabled comparison with corresponding statistics of other Danube countries, received from the Danube Commission, with headquarters in Budapest.

The data collected through this research are also used for calculating global statistical indicators, such as physical volume index of transport services. The obtained results are sent to international organizations dealing with transport, such as The Danube Commission, UN ECE-inland transport committee, Organization for Economic Cooperation and Development (DUNCOM, UN ECE-IT and OECD), etc.

2. TOTAL INTERNATIONAL FREIGHT TRANSPORT

Total international freight traffic in the period 1996-2006, annually increased by 10.8% on average. Export of goods realized by all transport modes, grew with the average rate of 10.9%, import with the rate of 6.7%, and in this period the highest increase rate of 12.8% was noted in

transit. Considerably higher growth rate were noted in the period 2001-2006, in comparison with the period 1996-2000. It is understandable taking into account that in 1999 Serbia was being destructed by NATO aviation. As a consequence, rail and inland waterway networks were particularly damaged. In the period 2000-2006 total international freight traffic increased at the annual rate of 20.3%. Export of goods grew at the rate of 15.9%, import at the rate 13.6% and transit at the rate of 34.4%. Although transit of goods performed by all modes of transport showed extremely dynamic growth rates in this period, it was noticed that the highest growth rate, with the reconstruction of our waterways, was recorded in inland waterways transit of goods.

In 2006, majority of total goods conveyed by all modes of international transport were transported by road freight vehicles, around 42.9%, 21.8% were transported by inland waterways, and 23.0% by rail transport and 12.3% is the share of oil and gas transported by pipelines. Looking back to 1996, it can be noticed that the largest amount of goods was carried by inland waterway transport (49.2%), followed by road transport (28.5%). In the same year the share of rail transport in total international freight transport was 14.1% and 8.2% was the share of pipeline transport.

2.1. Export of goods by modes of transport

Total export of goods realized by all modes of transport in the period 1996-2006 grew at the average annual rate of 10.9%. The highest growth rate in this period was registered in rail transport (15.4%); a little bit slower increase was noted in road transport (12.8%) and the slowest raise of 3.6% was in inland waterways transport. Significantly slower growth rate of 3.8% in export was noted in the period 1996-2000, in contrast to the period after 2000, when the export increase rate was 22.9%.

Comparing different modes of transport, it is apparent that from 2000 to 2006, the fastest export increase was in rail transport, as it increased almost four times during this period, road transport increased about 2.5 times and inland waterways transport more than 2 times. Share of road and rail transport in total export increased during the period 1996-2006, unlike inland waterway transport whose share dropped from 35% to 17.9% in 2006.

Export of goods to European countries in 2006, compared to 1996, a year before the NATO aviation aggression, was over three times higher. Transport by rail was almost four times higher, transport by road three times and inland waterways transport over two times higher.

Compared to 2000, total export of goods to European countries, done by all odes of transport, was almost three times higher, where a fast growth over five times was noted in rail freight transport.

Total export of goods to the EU countries in the period 1996-2006 increased by 3.8 times, but with different progress rates in various modes of transport. Thus the rail freight transport in the observed period was almost 14 times higher, road transport 3.8 times higher and inland waterway transport by 22.3% higher.

Total export to EU member states in 2006, compared to 2000 was over 3.7 times higher, where the fastest rise of over 11 times was recorded in rail transport. In the same period export of goods to EU member states by road increased 2.6 times and export by inland waterway transport 2.5 times.

Total export of agricultural product realized by all modes of transport in 2006 was 1782 thousand tons, whereof cereals made over 68%. Export by road made more then half of total amount of exported food products, export by inland waterways almost two fifths, while the rest was exported by rail. Export of metal products was 1463 thousand tons, of which the largest share of 657 thousand tons comprised plates, wires and other construction materials for railway tracks. Over two fifths of the products from this group were transported by rail.

The export of machinery, transport equipment, manufactured goods and miscellaneous articles was 1379 thousand tons, where four fifths of the goods were transported by road. The export of crude and manufactured minerals and building materials was 895 thousand tons and majority of it, almost two fifths was transported by inland waterways.

2.2. Import of goods by modes of transport

Total import of goods realized by all modes of transport in the period 1996-2006 noted a slight slower rate in comparison to export growth rate. In the referent period, average growth rate of import was 6.7% while the highest increase rate of 13.7% was noted in pipeline transport. Road transport recorded annual growth rate of 7.0% and rail transport of 5.9%. Compared to other transport modes, the lowest growth rate of only 1.5% was noted in inland waterway transport.

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In the period 2000-2006, overall import of goods was 2.1 times greater. The fastest growth rate of almost eight times was recorded in pipeline transport, mainly because of the reuse of oil pipelines from Omisalj (Croatia) to our refineries in Novi Sad and Pancevo. In the same period, rail transport increased by more than two times, road transport by 67.6% and the lowest increase of 30.4% was noticed in inland waterway transport.

Total import of goods from European countries in the period 1996-2006 increased almost two times with equal growth rates in all modes of transport. Therefore, rail transport to European countries in the observed period was two times greater, inland waterway transport more than two times and road transport almost two times.

In the same period import of goods from the EU member states increased three times and transport of goods by road increased over three times. Import of goods from the EU by inland waterways was the only mode of transport with negative trend, meaning that it decreased two times. In 2000, 79.6% of total goods from the EU countries were imported by road transport and the rest by rail and inland waterway transport. Six years later, in the trade with the EU, road transport was still a dominant mode of transport, as almost three fifths of total goods, for our economy needs, were transported by road. A third of the goods were transported by rail, only 4.8% by inland waterways and 3% by pipelines (natural gas from Hungary).

Almost two fifths of the total import of 15723 thousand tons referred to crude oil and its products. Import of crude oil was 2222 thousand tons; import of gas was 3333 thousand tons, while amount of imported refined oil products was 420 thousand tons. The largest amount of this type of goods was imported by pipeline transport (over four fifths), followed by rail and inland waterway transport. Import of ores and metal waste was 1929 thousand tons and import of solid mineral fuels was 1594 thousand tons.

The largest amount of imported ores and metal waste was carried by inland waterways, 88,5% and share of this mode in solid mineral fuels import was considerably small, taking into account the composition of goods (a fourth of total import was transported by inland waterways). This group of goods was mostly conveyed by rail, over three fifths of the total quantity. Imported metal products were mostly carried by road, 45.1% and by inland waterway transport 19.7%. Referring to the import of machinery, transport equipment, manufactured goods and miscellaneous articles, 40.8% of total goods were transported by road and a third by rail transport.

2.3. Transit of goods by modes of transport

Total transit of goods over the territory of Serbia, related to all transport modes, increased by 3.5 times in the period 1996-2000. The fastest increase was recorded in goods transported by road vehicles, while slowest increase was noted in inland waterway transport, i.e. transport on the Danube.

Out of 17555 thousand tons carried in transit by rail, road and inland waterway transport in 2006, 4037 thousand tons were transferred from and to Turkey via our transportation network, out of which 75% was transported by road vehicles. In goods transit to and from Bulgaria, 3876 thousand tons were carried, out of which 57.8% by road, 32.0% by rail and 10.2% by inland waterways. In goods transit to and from Greece, over Serbian transportation network, 2137 thousand tones were transported, whereof 46.1% by road and 53.9% by rail. Total transit between Germany and Serbia was 3324 thousand tons of goods and between Serbia and Romania 2974 thousand tons.

3. INLAND WATERWAYS TRANSPORT

Besides the Danube, the international rivers Sava and Tisa with their tributaries and navigable canals provide 1360 km of navigable waterways for the ships with carrying capacity of up to 400 tons. The majority of ports in Serbian part of the Danube, after the construction of the big dam have been equipped to provide docking for smaller river-sea boats. This significant improvement in navigation enables direct transport between Serbian ports on the Danube and the sea ports on the Black and Mediterranean Seas, without reloading in ports situated in the delta of the Danube.

After years of stagnation due to the destruction of the bridges on Sava and the Danube (1999), building of new and reconstruction of old bridges, as well as after clearing of waterways, regular navigation through Serbian part of the waterways to the Black Sea was enabled. Building of the waterway Danube-Main-Rhine facilitated successful connection of river ports on the Danube with the ports in The Rhine river basin and the Northern Sea ports. Building of the

navigable canal Cherna Voda-Constanta shortened the waterway to the Black Sea for over 200 km. Total international goods transport by inland waterways in 2006, compared to 1996 increased by 11.7%, with slightly more dynamic increase of export (43.2%) and import (16.8%). Nevertheless, in the period 2000-2006, after clearing the waterway network, total international inland waterways transport increased by more then 3.5 time, where extreme rise of more then 16 times was noted in transit transport of goods.

3.1. Export of goods by inland waterways

Somewhat more then fifth of the total amount of goods exported by inland waterways in 2006 was carried to the EU member countries. 15.8% of the total export to the EU was carried to Germany on waterway Danube-Maine-Rhine. Three fifths of the total goods in export were exported to the river-sea ports on the Black Sea, out of which, more then a half was transported through reloading into sea boats, to the countries of the Black Sea region. By reloading to sea boats, majority of goods were exported to Italy, Spain and non-European countries.

Less then one fourth of the total 1472 thousand tons was transported by Serbian boats. The largest amount of the exported goods was carried by Ukrainian and Romanian boats.

3.2. Import of goods by inland waterways

Only 18.4% out of the total of 3406 thousand tons imported to Serbian ports were carried by Serbian boats. Not even a single ton was carried by Serbian boats in external trade with Austria and Slovakia. It is interesting that vessels of all other countries of the Danube region except Serbia were included in goods import trade with Austria. Only 157 thousand tons of goods were imported from the EU countries. The largest quantities of goods were imported from the river-sea ports in the lower basin of the Danube. Hence, 1693 thousand tons were imported from Romania and 1516 thousand tons from Ukraine. However, only 282 thousand tons of goods imported from Romania were of Romanian origin.

Referring to 2006 export, agricultural products presented the major part amounting to 51.2% of the total export. Cereals had the largest share in export form this group, 98.1%. Export of crude and processed minerals was 330 thousand tons, whereof cement and lime made 16.3%. In the same year, 248 thousand tons of metal products were exported. Almost half of it referred to steel plates.

During 2006, over 500.0% of the imported goods related to ores and mineral waste, whereof 94.8% was iron ore. 409 thousand tons of solid fuels were imported, 376 thousand tons of metal products and 362 thousand tons of fertilizers.

3.3. Transit of goods by inland waterways

In 2006, 4146 thousand tons were carried in transit over the Danube. The largest amount of goods was loaded in Ukraine, 40.0%, then in Romania, 12.4% and in Bulgaria 7.8%. 10.8% of the goods in transit were loaded in the countries outside the Danube river region, carried over Serbian waterways for unloading to the countries of the Black Sea region.

In the same year, the largest quantity of goods carried by the Danube in transit through territory of Serbia was unloaded in the EU countries, about 63.8%. 65.5% of the total goods unloaded in the EU were unloaded in Austria and about 25.3% in Germany.

The largest volume of goods flow in transit was between Ukraine and Austria, 27.9% of total transit. Also significant goods flow in total goods transit by inland waterways of the Republic of Serbia were done between Ukraine and Croatia, as well as between Romania and Austria, with shares of 13.4% and 12.3% respectively.

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