A Study on the Development of Intermodal Freight Transport between Belgium and Bulgaria

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Introduction

This paper presents major results obtained from the jointed Belgian – Bulgarian project "Development of new strategies of intermodal transportation chains along the Rhine – Main – Danube corridors", implemented under the frames of bilateral cooperation program.

The aim of the project is to study the possible development of freight intermodal transport chains between Belgium and Bulgaria, between North and Black sea, taking inland waterway transport (IWT) as basic mode. The key focus is on the assessment of the benefits if an intermodal transport is adapted in place of the unique mode transport used currently.

Starting from the examinations of Transport European infrastructure networks of four main transport modes (rails, roads, short sea, and inland waterways), specifically the possible connections (intermodal chains) between Belgium and Bulgaria, the paper will define different transport alternatives and appropriate scenarios for realising predicted cargo flows (transport demands) between the two regions (counties). Comparative analysis of the different transport alternatives was made on bases of cost criteria (internal and external).

The results of this study clarify the advantages of intemodal transport for investigated scenarios through the transport cost evaluation and benefit assessment. They can be further used in the concrete transport plans, corridor design and the policies elaboration.

1. Description of transport alternatives

The trans-European infrastructure for four transport alternatives (river, highway, rail and sea) is invented basing on the investigations of great numbers of technical specifications and geographical maps [1], [4], [6], [9], [10], [12].

Transport Infrastructure along the Rhine -Main-Danube corridor

Basing on the initial project concept - development of intermodal transport taking inland waterways as basic transport mode, the study made extreme detail examination of the

inland waterway infrastructures, including all cartographic and technical data of rivers, canals, and disposal hydro facilities along the corridor.

The annual cargo capacity per direction and annual number of convoys/ships per direction of the waterway infrastructure for each harmonized section along the corridor is calculated.

Fig. 1 is a map of trans-European Rhine – Main – Danube corridor. Fig. 2 contains, besides network parameters, locations of main hydro - technical facilities along the Main –Danube corridor.

Fig.1 The inland waterways between Black sea and North sea

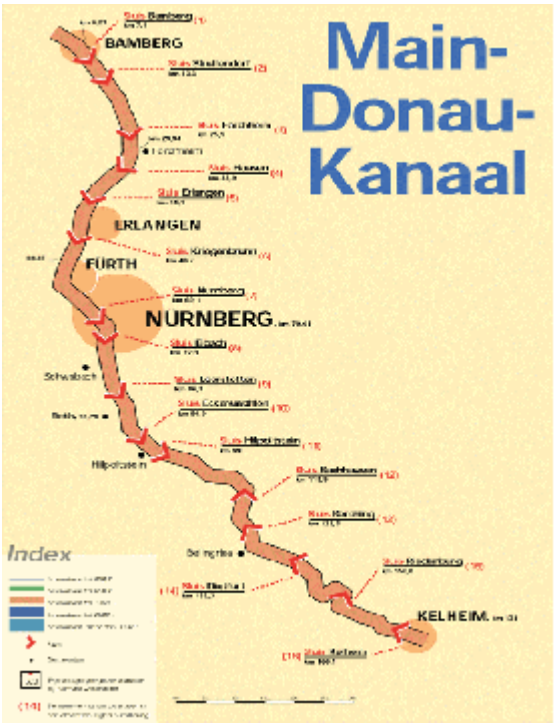

Fig.2 Map of Main – Danube canal infrastructure

Fig.3

Railways and highways infrastructure between Belgium and Bulgaria

Similar to inland waterways, assessment of railways infrastructure between Belgium and Bulgaria has been performed too. Fig. 3 shows the assembly map of European railways.

All main nodes along between the origin and destination are considered. As well known, they are practically identical for rail- and highways, which explains small differences in the distances between them along the corridor.

Short-Sea shipping transport

The sea rout?s (fig.4) can be traced back to ancient age and they have not changed since quit long time. The marine link between Black sea – North sea has long history. With the civilization and modernization, the route does not change but operating vessels as well as the port infrastructure/organization do dramatically changes

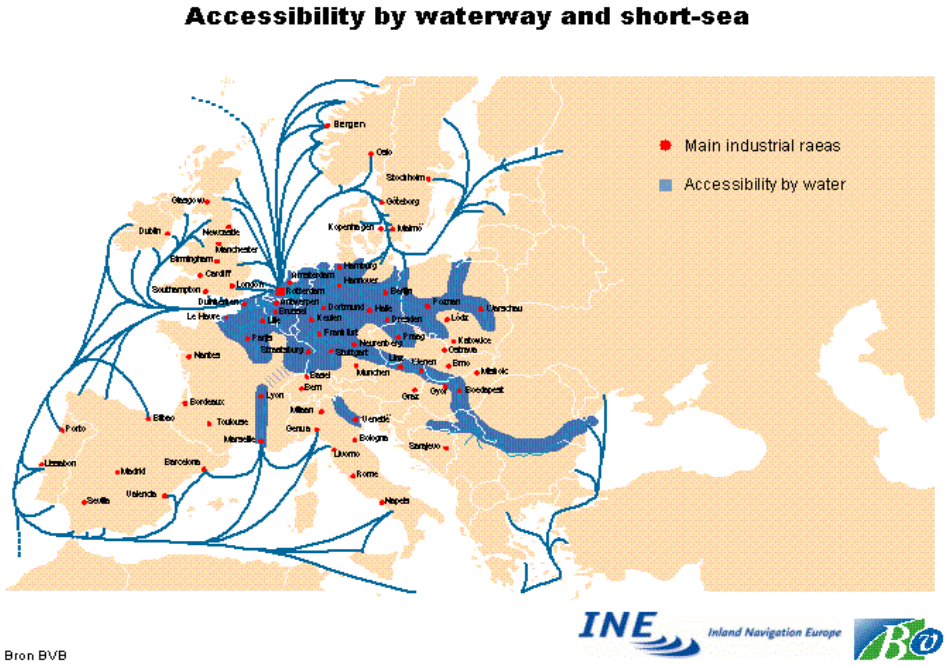

Fig.4

Intermodal Terminals

At present, the implementation of intermodal transport conception is the most important goal of united Europe in the field of transport. Nevertheless, not more than 10% of all exchanged cargo flows in European regions are practically transported by intermodal manner.

One of the main prerequisites to achieve the goal is availability of special technical facilities and depots that make easy and quick change of the transport mode for containerized cargoes.

Data for container terminals of significance along the destinations have been accumulated. Location, entrances, exits and contact co-ordinates (phone, fax, e-mail, etc. communications) for more then 60 container terminals are available so far.

Above-mentioned description of the various transport alternatives has been summarized in tables containing main nodes between origins and destinations and distances between them. They serve as inputs for transport cost calculations.

2. Cargo traffic between Belgium and Bulgaria

Existent Transport Demands

The cargo flows for 1992, [11], between Bulgaria and Belgium and vise versa, as shown in Fig 5, are used as a basis for assessment.

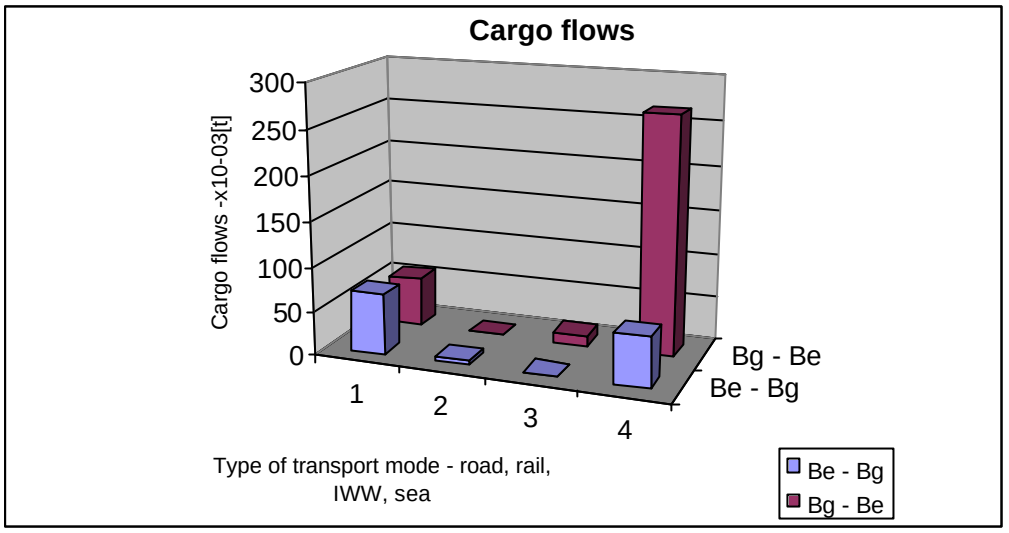

Fig. 5

Considering the geographical position of Bulgaria in the road between Western Europe and the Middle East, reported cargo flows can be judged modest. This is most probably caused by the Bulgarian registration regime, which until recently differed from that adopted in West Europe. As a consequence, cases of transit haulage with reloading on another type of transport (i.e. ship - truck), or transit with depositing (i.e. ship – store – outgoing transport) have been probably excluded from the total number of shipped cargo volume and have been calculated into international import/export cargo flows.

After analyzing the data, it is possible to conclude that:

- Substantial part of trade between Bulgaria and Belgium and vice versa is realized by sea, using ports of Oostende, Antwerp, Rotterdam and Amsterdam, and ports of Varna and Burgas respectively.

- Ranged in second place come cargo flows transported by road.

- The volumes of goods transported by rail and especially by inland waterways are insignificant.

- The most important initial stations (almost equipollent) for admittance of Bulgarian goods for road, rail and IWW transport modes are Rotterdam, Groningen, Antwerp, Amsterdam and Eindhoven.

Demands Forecasts

On the base of existing traffic between Belgium and Bulgaria, a middle-term forecast of tendency nature has been developed.

The future goods exchange volumes are expected to be, as follows:

- The export from Benelux to Bulgaria will increase till 2010 with some 95 percents, at this:

  - The road transport will remain one of the most utilized modes of transportation, and it is expected its importance to increase even further, to occupy the first place in shares;

- The transportation by sea, even if yielding its first priority, will keep significant share in total freight;
- Regardless the tendency in EU transport policy of increase in rail and waterway transport utilization, their share will remain insignificant.

- The import in Benelux from Bulgaria is also expected to increase till 2010 with about 50 percents, at this:
  - The sea borne transport will keep its leading position, whilst about 80% of the total freight will continue to be shipped by sea;
  - The share of all other modes of transport, namely road, rail and inland waterways, will remain almost unchanged.

Considering the unified cargo flows, transported from Western Europe eastward and backward via Bulgaria or via other alternative routes across Balkan Peninsula, it should be emphasized, that so far it has been realized mainly by autonomous motor transport, which is not a subject of the intermodal technology. The lack of circumstances for application of the classical intermodal technology of continental type by using rail transport for trunk shipment across former East-block countries makes the variant of main freight along Danube River the only alternative.

3. Definition of Scenarios

The economic efficiency, capacity reserves of the ships, terminals and waterways, environmental impacts, traffic safety and external costs have to be taken into account to compare transport modes used. The decisive parameters for the selection of the means of transportation are reliability, speed and price.

It is well known, that the building of the transport scenario depends to a great degree on its target.

The scenarios in present development are built on forecast of back costs and the basic parameter for comparison is the transport cost, i.e. economic efficiency.

3.1 Existent Modal Shares - Basic scenario

We assume the four single transport modes, described in it.1, (rails, highways, IWW and maritime) as the basic scenario.

3.2 Shift Scenarios

The characteristics of the cargo being transported (so called “transportation sensitivity”, i.e. perish ability, fragility, sensitivity to cold, heat or water), as well as the demands of the recipient (technical or market specific requirements such as delivery time limits, as well as subjective preferences) define the shift ability of certain cargo between means of transportation.

There is a possibility to shift cargoes from road transport to rail or to inland waterway. The preliminary investigations show that rail transport mode has a comparatively high price and inland waterway is more attractive transport mode for present development.

The circumstances defining the shifting possibility are:

- the availability of inland waterways and ports near to the location of cargo origin and destination;
- the quantity of cargo for transportation – its volume should be enough for ships;
- the transport cost for two modes used by customers must be less or near to the road transport cost;
- the time needed for transport has to be satisfactory for the customers;
- the infrastructure of inland waterway has to permit regular and safe navigation.
- the transport chain with integration of the inland waterway mode has to be integrated in the customer logistic chain.

In present development the hypothetic shifting possibility for 10%, 20% and 30% of cargo's volume from road to inland waterways is considered. As in the Item 3.1, only single transport modes are considered – road and IWW.

3. 3 Container scenario

To make comparison more clear, we assume that 90% of road transport cargo is packed in containers and is transported by trucks. All trucks are fully loaded (100% weight of one container is assumed 22 tons).

3.4 Intermodal Logistical Chains

If necessary infrastructure is available, the choice of transport modes used for intermodal transportation depends of all above mentioned parameters and additionally on time and charges for container (trailer) trans-shipment.

For intermodal transportation in our case (Bulgaria – Belgium and vise versa), inland waterway and road transport modes are suitable.

- First assumption is that 90% of transferred cargo volumes are situated in 20ft containers.
- Second assumption is that for all containers the intermodal transport share for the road portion Cologne – Rouse is affected by waterway. Cologne is assumed the point of transport mode interchange (mainly road transport) to different cities in Belgium and the Netherlands.

4. Comparative Analysis of Freight Transfer Costs for Several Transport Alternatives

Transport Cost Computation

Direct Transport Costs

There are numerous developments for transport cost calculation of every single transport mode. All these costs are so called direct or internal costs. Their structure can be divided into two main groups – fixed taxes/costs and variable taxes/costs. The structure of transport cost is similar for all transport modes [5], [6], [7], [8].

In according with the world trends and governmental policy (most clearly expressed in highly developed countries) nowadays, the most numerous are developments in the field of container cost calculations on the base of some different transport modes. [5]

It is well known, that the transport cost is different by transport providers. Because our aims are comparative qualitative calculations, we take average values of transport cost.

External Transport Cost

All transport modes (water, rail, air, truck) affects the environmental components of sustainability. The cost of transport not always includes the entire costs associated with the environmental aspects of the transport system.

These costs, for which the user of goods or service (such as infrastructure) does not pay, or costs imposed on others and not borne by the party responsible for the cost, are external.

For example, direct transport cost of 1t*km for road transport is possible to be less in comparison with those for inland water transport, but external costs created by road traffic is much higher than those created by waterway traffic (up to 5.5 times higher per t*km). Waterway transport is friendliest for the environment and is often the most economical mode of transport.

The external costs of transport are large (estimated at about 8% of EU GDP (INFRAS, 2000), but the estimates are uncertain. The most important categories of external costs are: climate change, air pollution and accidents. Congestion is one of the highest components mainly for urban transport.

Road transport, which dominates all mobility volumes, is responsible for more than 90% of total external costs. Road vehicles usually also show relatively higher average external costs per passenger*km than other modes – although the newest vehicles perform better from this point of view.

Published in different issues studies on the external costs, including, type of effect, cost components and most important assumptions for their estimation are summarized and deeply analyzed in the reference [1].

The significant components evaluated for the whole external cost value are respectively:

costs for accidents, noise, air pollution, and climate change congestion, nature and landscape, separation in urban areas, space scarcity in urban areas, additional costs from up and downstream processes. External costs can be also classified as fixed and variable.

We have got the real data for road and inland waterway transport external costs.

To evaluate the influence of external cost additional scenario has been developed on the base of collected data – transport expenses calculations for cargo volumes transferred by road and inland waterways transport modes.

Transport cost calculations are developed on the basis of scenarios described above and accepted average costs – fig.6.

Analysis of the calculated transport expenses

After transport cost calculations for above mentioned scenarios (it.3) and real average single transport cost (without considering of other transport service parameters), is evident, that:

- The transport expenses of waterborne transport are 5 times lesser in comparison with that of road and rail transport for the same ton.km.

- External costs influence – Fig. 7 and Fig. 8

External costs incurred for the road and IWW transport expenses increase with more than 80% (85% for road and 82% for IWW). The relationship between single cost (1tkm) remains almost the same – decrease with 2%.

- c) Shifting scenario – Fig.9 and Fig.10

Shifting of every 10% of cargoes leads to 8% total amount decreasing of transport expenses.

- d) Container scenario

The haulage of the same quantity cargoes in containers instead of bulk decrease significant the funds necessary for transferring – If 90% of road cargoes are in containers - not bulk, we will economize 15% of road transport expenses – Fig. 11.

- e) intermodal scenario-

If 90% of road cargoes are in containers and these cargo volumes are transferred by intermodal manner using two modes – road in the BENELUX and IWW from Cologne to port of Russe, Bulgaria, the transport expenses decrease with 65% - Fig.12.

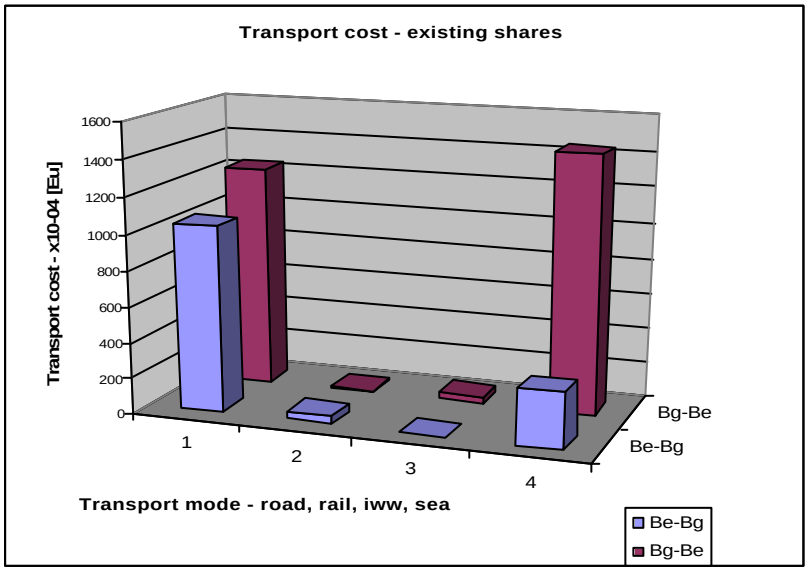

Fig. 6

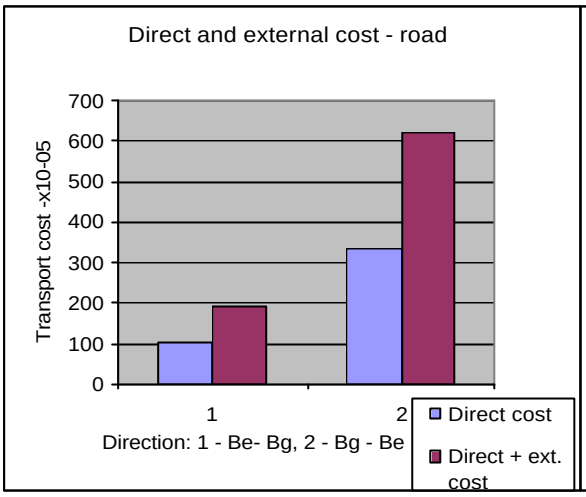

Fig. 7

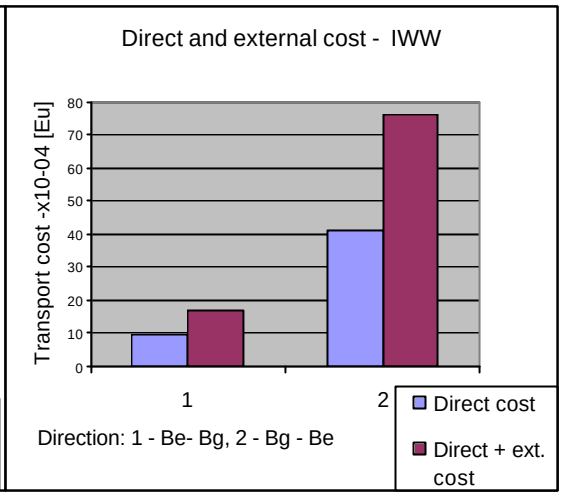

Fig. 8

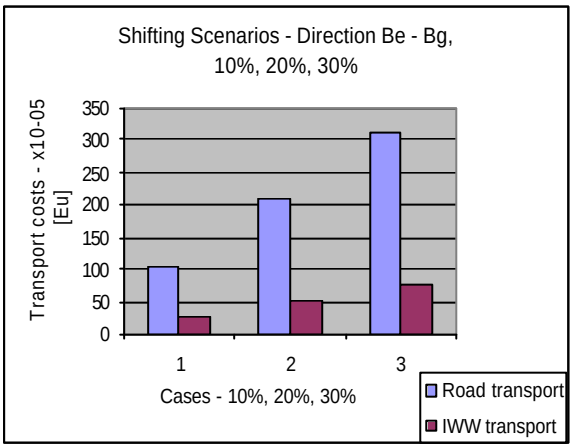

Fig.9

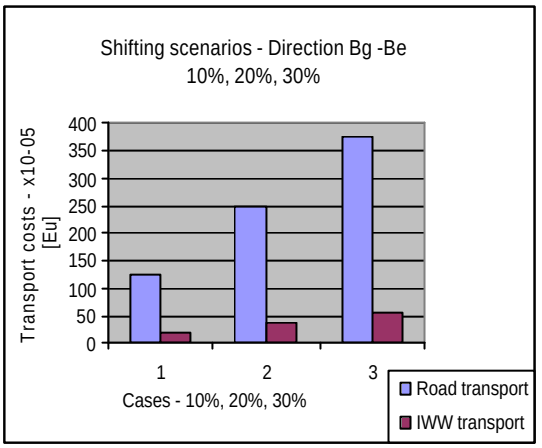

Fig.10

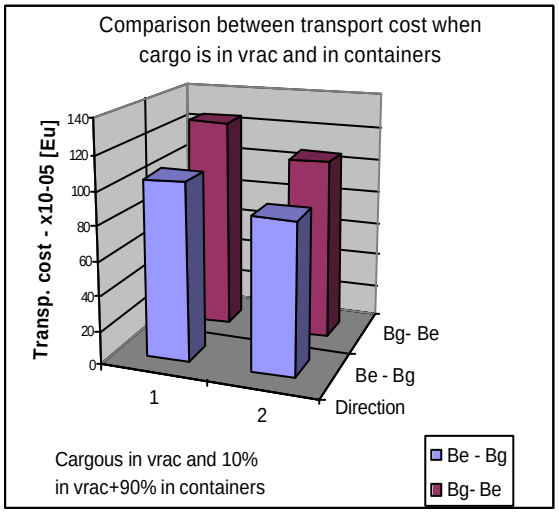

Fig. 11

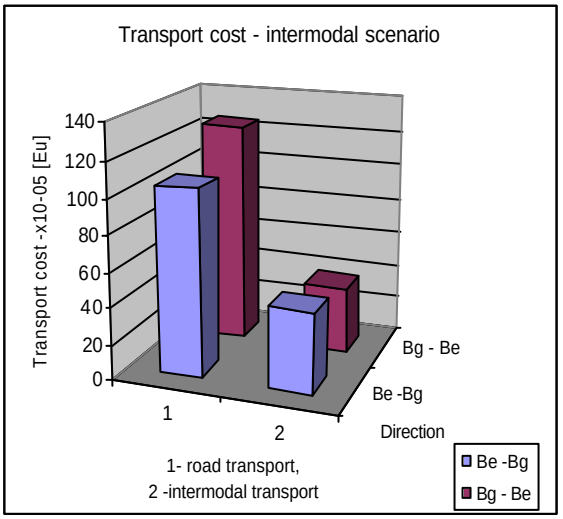

Fig.12

5. Conclusions and recommendations

In continuation of a number of previous developments at ANAST –ULG [1], [5], [6], [7], [8], [10], [12] etc., a feasibility study on possibilities of different transport alternatives between Bulgaria and Belgium was performed under the framework of bilateral cooperation agreement.

Within the frames of the project, detailed description of the transcontinental transport infrastructure has been made.

On the basis of middle term transport demand forecast the following scenarios have been investigated:

- Four single transport modes;
- Shifting scenarios;
- Container scenario for road transport;
- Intermodal scenario – IWW+road.

The operational transport cost for each scenario has been calculated and analyzed of the results has been made. Following conclusions have been drawn:

- If 10%, 20% or 30% of cargo transported by road is shifted to IWW, the amount of total transport expenses will decrease with 8%, 16% and 24% respectively;
- If 90% of road cargos are in containers - not in bulk, 15% of road transport expenses will be spared.
- If 90% of road cargos are in containers and these cargo volumes are transferred by intermodal manner using two modes – road in the BENELUX and IWW from Cologne to port Ruse, Bulgaria, the transport expenses decrease with 65%.

Additionally, the influence of the external costs on the transport expenses of the road and IWW transport mode has been evaluated, taking into account results in increasing of transport expenses with 85% for road and 82 % for IWW.

The results obtained are based on assumptions and its applications are under the conditions of restrictions including availability of large stable and regular cargo flows. They couldn't be taken as pure quantitative evaluation. but a way to show the great possibilities and capacity of development of inland waterways and intermodal transport.

The results of present analysis give hints for continue studies on trans-continent intermodal transport toward following four levels: level of details – quantitative analysis, level of practice –market investigation, level of involvements-actors / operators and level of usable – concrete strategies and measures to develop the intermodal transport with integration of IWT mode.

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