METHODOLOGY OF INLAND PORTS DESIGN AS INTERMODAL TERMINALS IN THE CZECH REPUBLIC

BÍNOVÁ Helena[1], JURKOVIČ Martin[2]

[1]Technical University in Prague, Praha, Czech Republic, EU, binova@fd.cvut.cz
[2]University of Žilina, Žilina, Slovakia, EU, martin.jurkovic@fpedas.uniza.sk

Abstract

In connection with the new focus on the European transport network TEN-T is very important to focus the logistics research on proposal of public logistics centres with access to the intermodal transport network. In terms of transport externalities and the capacity of existing transport infrastructure, for future transportation of goods within the EU are very perspective inland waterways and rail network. Especially for inland water transport, there are capacity reserves for the transport of other commodity flows. The Czech Republic prepares projects for full navigability of the river Elbe and Vltava, which will enable full navigability from Czech ports to the seaport of Hamburg and other northern European seaports. Inland waterway ports may become important intermodal terminals. During the project of a new public logistics centre in Pardubice, East Bohemia, which will be end port on the Elbe waterway, a new methodology of design was created and is described in this paper.

Keywords: Public logistic centre; flows of goods; transportation networks; terminal; transport forecasts;

1. INTRODUCTION

The development of public intermodal logistic centres represents a very demanding investment, in particular in terms of connection to the transportation intermodal infrastructure, as there usually is not a compact area available with direct access to such infrastructure and at the least a suitable locality satisfying the flows of goods. The methodology of the design of logistic centres in relation to the analysis of the flows of goods at the place of production and consumption, transit flows of goods related to the transportation network and forecast of their development. Related production and technology groupings (technological parks, industrial zones) well accommodate this concept. This relationship enables the efficient design of co-operating logistic and transport solutions. New methodology for an expert design of a logistics centre in relation to the flows of goods, related transportation networks and calculation of economic efficiency is described.

The model is disassembled into separate and related segments. A risk analysis method is applied for a variant solution of the related transportation networks. The efficiency of the disassembled model is based on the analysis of benefits and costs. Very important are benefits for the society as a whole that may be used to argue for the support of projects for logistic centres from public funds.

It is necessary to take into account planned canal Danube - Oder - Elbe and Port of Pardubice in Czech Republic. In the case of its implementation, it will be a multifunctional water work, which will connect a system of European waterways. It is very important project - this project as a potential future development of the waterway in the Czech Republic.

2. THE PORT OF PARDUBICE AND A PROJECT DANUBE - ODER - ELBE

The future end port on the Elbe River in the Town of Pardubice (the Czech Republic) is long-term prepared project, which is closely related to the project of ensuring year-round navigability of the Elbe and ensuring a waterway to the seaport of Hamburg and other northern seaports. The European Commission tabled on the 19th of October 2011 a plan to improve Europe's transport, energy and digital networks (new Trans-European

Transport Network (TEN-T)). In this plan the Elbe waterway with the end port of Pardubice is integrated into the main network projects (see **Fig. 1**).

The end port of Pardubice together with the construction of public logistics centre implies connections for industrial agglomerations in surrounding large regional cities of Pardubice and Hradec Králové. Thanks to the connection of these agglomerations with adequate waterways, the inland waterway transport in the Czech Republic will achieve very interesting economic potential in the transport session Pardubice - Prague - Děčín - Hamburg. The significance of these traffic routes is clearly documented also by construction and use of road and rail transport routes, which are with some simplification parallel with the waterway [3].

In connection with the work on this project a new Methodology of the Design Logistics Centres has been developed, and it is mentioned in the following chapters.
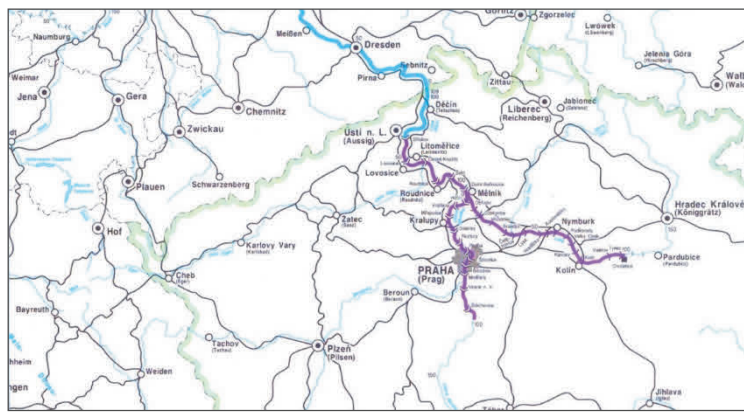
Fig. 1 Location of the port and public logistics centre in Pardubice [8]

An important aspect is the possibility of a future connection with a long-term planned project of interconnection of the waterways Danube - Oder - Elbe.

Designing of the Danube - Odra - Labe corridor takes into account the exceptional benefit of the Czech Republic area, which is the lowest point of the European water divide between the Danube and the Odra rivers (the Moravian Gate) whose length should be about 370 km at the current state of the implementation. The Czech Republic is the only country from all the of twenty-eight EU member states that is not connected with the sea directly or by a quality waterway. Considering the fact that the price of each item of goods incorporates a significant part of the transport cost (ca 40 - 60 %), it is evident that construction of high-quality watercourse connection with the sea represents one of the key issues for the Czech Republic [7].

The currently being prepared construction of the D-O-L water corridor is divided into four stages:
- 1st stage - connection of south Moravia with the Danube River by a waterway and canalization of the Odra River to Ostrava,
- 2nd stage - prolongation of the water corridor from Hodonín to Přerov, utilization of features implemented during construction of the Baťa Canal,
- 3rd stage - prolongation of the water corridor from Přerov to Ostrava with a potential navigable branch to Olomouc, thus creating a strategic north-south connection,
- 4th stage - prolongation of the water corridor from Přerov (Olomouc) to Pardubice, thus connecting west Bohemia with east territories of the Czech Republic (Moravia and Silesia) by a waterway.

If this navigable canal is successfully implemented, the Pardubice port would find itself, together with Přerov, in the very centre of the waterway. It would thus ideally locate the terminal in a junction of waterways across Central Europe. The proposed public logistic centre in Pardubice would thus be connected with seaports in

Germany, but also the traffic artery of the Danube, thus the Black Sea ports and then the Baltic Sea through the Odra River via another important port of Štětí.

At present, support of this project is not strong enough for its implementation in near future. It is thus necessary to understand this project as a potential future development of the waterway in the Czech Republic.

For the Danube region the multi-port gateways of the Black Sea West region, the Northern Adriatic Region and (traditionally) the North Sea Ports play a fundamental role in trans-continental transport (see Fig. 2).
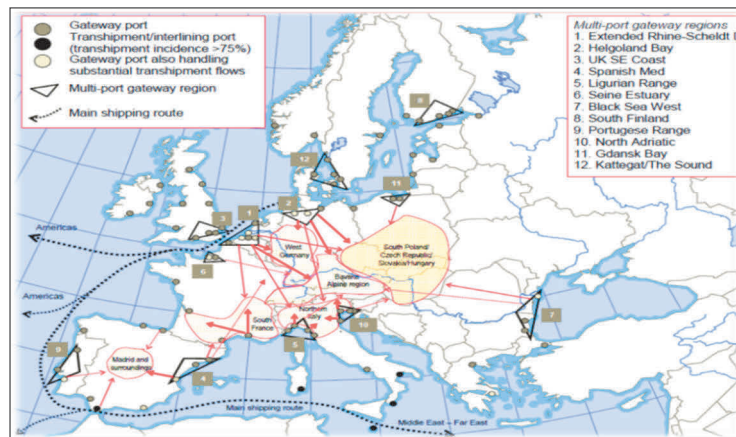

Fig. 2 European multi-port gateway regions [4]

Methodological approach

Intermodal freight transport is defined as transport of goods in one and the same intermodal transport unit (container, swap body or a road or rail vehicle or a vessel) by successive modes of transport without handling of the goods themselves when changing modes (EUROSTAT - ITF - UNECE Glossary for Transport Statistics. The intermodal transport system consists of the infrastructure and transport equipment (physical subsystem) and the intermodal services (market/services subsystem) [2].

The project will consist of a two-pillar approach:

- The project will contain a thorough analysis of the current conditions of intermodal freight transport in the Danube region leading to a synchronized sustainable strategy for the whole Danube region. All involved parties will participate in the development of the strategy by means of workshops, discussion rounds, feedback loops etc. The main goal is to ensure joint identification with the strategy. At the same time the strategy has to be in line with all other strategies in the region. The involved parties will ensure this flow of information [5].
- The second pillar consists of extensive capacity building for the main acting parties (including trainings and the preparation of guidelines). This will raise the ability of the involved acting parties to later implement the recommended actions.

3. **THE METHODOLOGICAL MODEL OF THE EXPERT'S PROPOSAL OF A LOGISTIC TERMINAL AND TRAFFIC NETWORKS**

The heuristic methods do not work with exact data and calculation methods but with knowledge and experience, experts assume that the results of the solution will very probably fulfil requirements for this solution. The methodological model of a logistic terminal is shown in the **Fig. 3** [1].

The main segments of this model are:

3.1. Freight flows - analysis, prognosis

We can use: prognostic methods; heuristic and expert methods.

Characteristics of and relations between the commodity flows are defined as follows [6]:
- The commodity flows for the logistic terminal in the given region.
- Network commodity flows.
- Forecasts of new commodity flows.

The proposed port of Pardubice, including public logistic centre also seems to be a suitable ending terminal for the LNG, which would be transported by shipping traffic on the river Elbe.
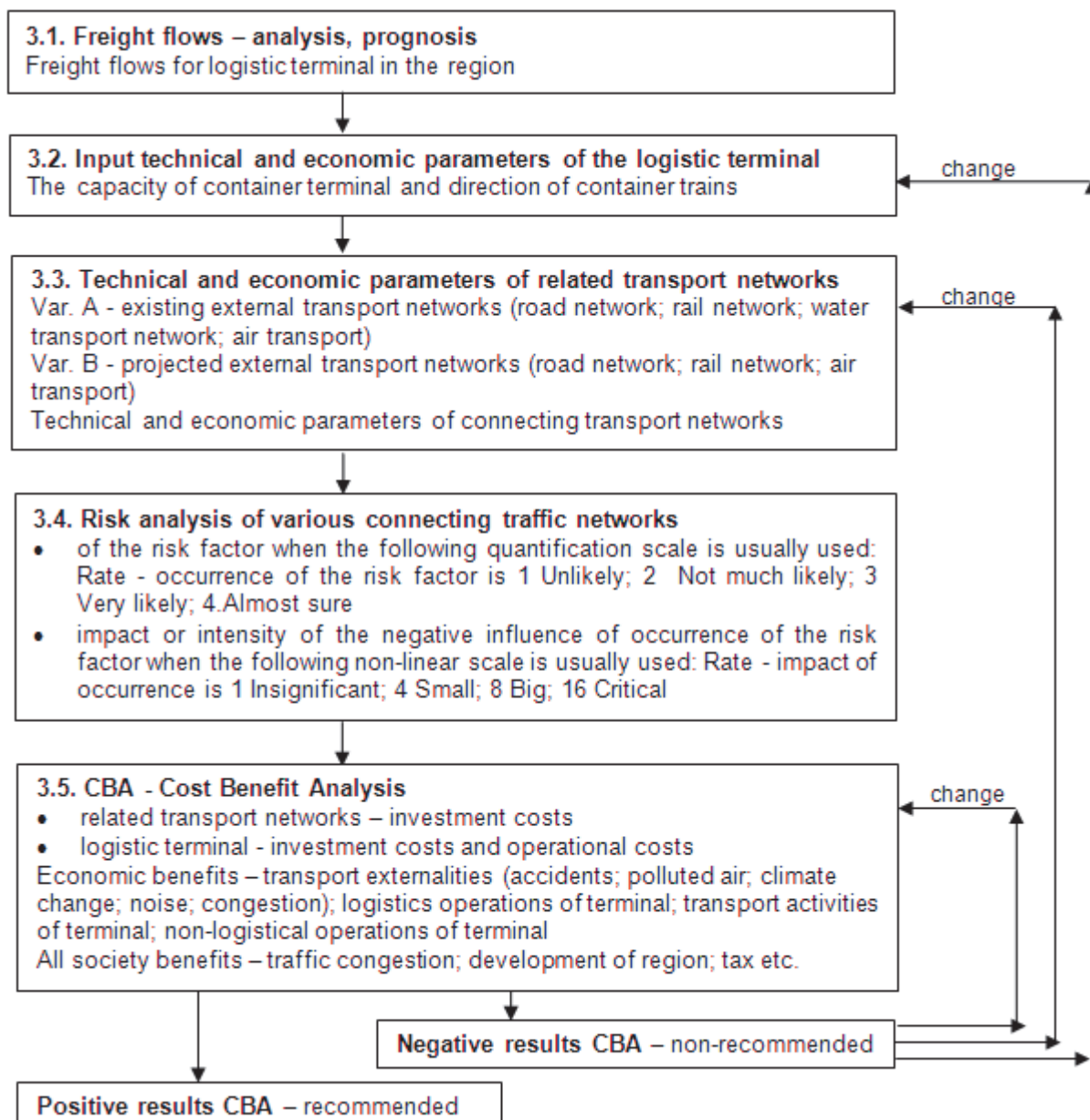

Fig. 3 The methodological model of the expert's proposal of a logistic terminal and connecting traffic networks (Source: authors)

3.2. Input technical and economic parameters of the logistic terminal

We can use: benchmarking comparision; expert methods.

3.3. Technical and economic parameters of connecting transport networks

We can use: calculation; benchmarking comparison; prognostic and expert methods.

The paper introduces the following definitions of traffic connections of the intermodal terminal with external traffic networks:

* Existing external traffic networks (Var. A) - the external traffic networks which exist at the time of proposal of the logistic terminal;
* Future external traffic networks (Var. B) - the external traffic networks for which a realization time schedule exists and which can be considered for the proposal of the terminal;

Decision-making process in Var. A and Var. B of related transport networks

* Investment costs for Var. A - Includes description of the existing external traffic networks including expert's (comparative) technical and economic parameters of the connecting traffic networks.
* Investment costs for Var. B - solution includes description of the future external traffic networks and description of the design of the connecting traffic networks including expert's (comparative) technical and economic parameters for all needed traffic modes specified in the input technical and economic parameters of the logistic terminal.
* Comparison of Var. A and Var. B
* If Var. B > Var. A - Var. B is further not observed
* If Var. A > Var. B - Risk analysis for Var. A and Var. B - the project is submitted for further evaluation

One of the most important factors in preparation of a quality engineering estimation is expert's experience.

3.4. Risk analysis of various connecting traffic networks

We can use: expert methods.

In regards to the planned constructions, i.e. canalization of the Labe River and the Danube - Odra - Labe canal, this evaluation is particularly important.

The highest-risk factors:

* exceeding the investment costs,
* implied investment costs,
* failure to keep the design parameters,
* failure to keep timetable of the construction,
* no funding,
* disapproval of the public,
* demanding geographical circumstances,
* unresolved property circumstances,
* environmental protection,
* rate of return,
* coordination between individual states,
* change of climatic circumstances.

3.5. CBA - Cost Benefit Analysis

We can use: calculation; benchmarking comparison; long-term financing

The traffic projects use dynamic methods for the project cost and benefit analysis (CBA) due to the fact that realization of the projects takes more years and the project lifetime runs for many years. Using of statistical methods would result in incorrect project evaluation results and therefore incorrect decisions. The whole process of this analysis is concentrated into the calculation of the fundamental characteristic indicators on the basis of which can be decided whether the project is acceptable or not.

Theoretical transport performances for the relation between a European port (for example, Hamburg) - inland ports in Czech Republic (for example, Přerov, Pardubice) can be calculated using the equation

$$t_{km} = Q \cdot l_n \qquad\qquad (1)$$

where:

t_{km} transport performance [t·km],

Q transport volume [t],

l_n transport distance [km].

4. CONCLUSION

In the article, methodology of the expert model for proposal of traffic corridors, public logistic centres and the ensuing external traffic networks is applied to the current needs - i.e. construction of a public logistic centre in connection with the proposed traffic corridors including the internal waterways, also in the long term. It is based on an analysis of the goods currents and their prognosticated development. Another important aspect is the CBA, which takes into account the economical as well as society-wide benefits, i.e. arguments for financing construction of transport corridors including new waterways and logistic terminals, which, however, should be connected to the railway network.

Regarding the follow-up traffic infrastructure, it will be necessary to apply methods of risk-analysis and evaluate risks connected with the individual currently being prepared projects, evaluate risks of the projects in their mutual synergy, with view to the fact that in the future, the implemented traffic corridors and logistic centres should jointly operate and mutually affect each other.

As regards the Danube - Odra - Labe canal, opinions on the construction are contradictory; however, it is necessary to realize that the construction is extraordinary in its size and significance. A view into history shows that similarly large projects were always conceived within a period exceeding the length of the human life. Thus, the economical evaluation needs to be conceived in a long-term outlook.

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