SSD

SCIENCE FOR A SUSTAINABLE DEVELOPMENT

DECISION SUPPORT SYSTEM FOR INTERMODAL TRANSPORT POLICY

"DSSITP"

C. MACHARIS, G. K. JANSSENS, B. JOURQUIN, E. PEKIN, A. CARIS, T. CREPIN

ENERGY

TRANSPORT AND MOBILITY

AGRO-FOOD

HEALTH AND ENVIRONMENT

CLIMATE

BIODIVERSITY

ATMOSPHERE AND TERRESTRIAL AND MARINE ECOSYSTEMS

TRANSVERSAL ACTIONS

.be

SCIENCE FOR A SUSTAINABLE DEVELOPMENT
(SSD)

Transport and Mobility

FINAL REPORT PHASE 1
SUMMARY

DECISION SUPPORT SYSTEM FOR INTERMODAL TRANSPORT POLICY
"DSSITP"

SD/TM/08A

Promotors

Cathy Macharis
Vrije Universiteit Brussel
Pleinlaan 2, B-1050 Brussel
Tel: +32 (0)2 629 22 86
cathy.macharis@vub.ac.be

Bart Jourquin
Facultés Universitaires Catholiques de Mons
Chaussée de Binche 15a, B-7000 Mons
Tel : +32 (0)65 32 32 93
bart.jourquin@fucam.ac.be

Gerrit K. Janssens
Universiteit Hasselt
Campus Diepenbeek
Agoralaan – Gebouw D – b-3590 Diepenbeek
Tel : +32 (0)11 26 87 00

Authors

Cathy Macharis(VUB), Gerrit K. Janssens (UH), Bart Jourquin FUCaM), Ethem Pekin (VUB), An Caris (UH), Thomas Crépin (FUCaM)

March 2009

Rue de la Science 8
Wetenschapsstraat 8
B-1000 Brussels
Belgium
Tel: +32 (0)2 238 34 11 – Fax: +32 (0)2 230 59 12
http://www.belspo.be

Contact person: Georges Jamart
+32 (0)2 238 36 90

PROJECT WEBSITE
http://www.vub.ac.be/DSSITPday/dssitp-day.html

Cathy Macharis, Bart Jourquin, Gerrit K. Janssens, Ethem Pekin, An Caris, Thomas Crépin ***Decision support system for intermodal transport policy "DSSITP"*** Final Report Summary. Brussels : Belgian Science Policy 2009 – 6 p. (Science for a Sustainable Development)

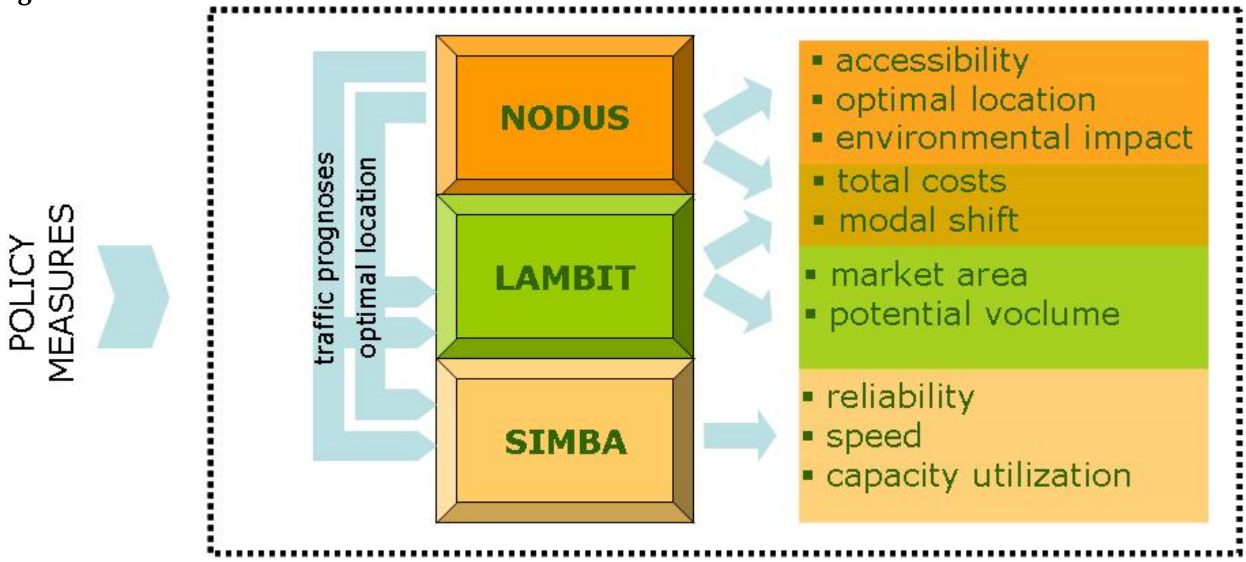
Intermodal transport receives an increased attention due to problems of road congestion, environmental concerns and traffic safety. As intermodal transport is more environmental friendly and provides a potential to reduce congestion, European policy as well as federal and regional policy measures try to stimulate growth in intermodal transport. Transport policy in Belgium is scattered over different policy levels. At present no post-evaluations of policy measures in Belgium are considered. This project aims to analyze how far existing policies have been effective and to investigate whether there are alternatives to stimulate growth in intermodal transport. The objective of the project is to develop a framework to assess policies intended to enhance the growth of intermodal inland waterway and rail transport. Both combinations have a particular market structure and operations, but it is important to analyze them together in order to take care of potential competition distortions.

The state of the art on intermodal transport serves as a background reference point for the project. First, intermodal transport is defined in accordance with the scope of the project. Second, the intermodal transport market is identified. The research team studied the evolution of intermodal transport in Europe. Available policy measures that stimulate intermodal transport have been listed. Various combinations of policy instruments or packages can be formulated along the intermodal transport chain. This requires a close co-operation among the stakeholders in order to create synergies. EU's intermodal policy sets the guidelines for a structured approach to intermodal freight transport. On the other hand, different transport policies are launched in the Member States to stimulate the use of intermodal transport but no integrated formal ex-ante and ex-post evaluation of these transport policies are executed. The DSSITP framework is set up to fill this gap. It provides a decision tool for stakeholders to assess the changes due to measures induced by public authorities. A stakeholder consultation allowed to collect relevant input data for the models that make up the DSSITP framework. A detailed survey of the inland barge terminals is conducted. Waterway administrators and the port authority of Antwerp are consulted.

From the state of the art on intermodal transport, the stakeholder consultation and the data collection a number of conclusions can be formulated. Transport policy in Belgium is scattered over different policy levels. For rail transport, the federal government has the largest responsibility. On the other hand, regional governments have greater influence for inland waterway transport. This context presents a threat by hindering further development of intermodal transport. Transport policies at the different levels need to be integrated in order to realize a global policy concerning intermodal transport. A second conclusion is that data on freight flows is difficult to gather and results in a very time consuming collection process. However, research on freight transport often depends on the quality of the input data. As the freight and logistic sector is in full evolution, relevant indicators are often missing, making scientific research, market research and policy making difficult. In addition, the Flemish data are not always comparable to the data of other European regions due to different definitions and/or collection methods. A common database on freight flows would imply a considerable increase in time efficiency for all researchers on freight transportation.

Modeling problems in intermodal freight transport are more complex due to the inclusion of multiple transport modes and multiple decision makers. An insight is given into the research field and modeling issues that still need to be tackled. A combination of simulation and optimization models is necessary to deal with this increased complexity in intermodal transport. As depicted in figure 1, the DSSITP framework is formed by three core models: NODUS (a multimodal freight model), LAMBIT (location analysis for Belgian intermodal terminals) and SIMBA (discrete event simulation model for intermodal barge transport). Each model has its own functions, which are complementary in order to analyze changes due to political measures. Due to the combination of the three models, the analysis of policy measures is performed on multiple levels of aggregation over multiple transport modes. Each model has its specific purpose and outputs.

Figure 1: DSSITP framework



The multimodal freight model NODUS is situated on the highest level of aggregation and constitutes the first step in the analysis of a potential policy measure. The NODUS model provides traffic prognoses which serve as inputs for the LAMBIT model and SIMBA model. The various outputs of the assessment framework are also stated in Figure 14. The NODUS model produces aggregated outputs of the various transport modes, such as their accessibility, environmental impact and share in the modal split. Total costs of an intermodal service are measured. In addition, the model is extended in order to provide optimal locations of terminals. These optimal locations may be introduced in the LAMBIT and SIMBA models. The LAMBIT model is scaled on the Belgian intermodal network. The model analyzes the potential market area of a new terminal and assesses the impacts on existing terminals. It further produces cost indicators and potential modal shifts. The SIMBA model is situated on the lowest level of aggregation and produces detailed output related to the reliability, speed and capacity utilization of the waterway network. With the SIMBA model, the impact of volume increases in the network or the introduction of new intermodal barge terminals can be simulated. Also alternative consolidation strategies may be compared.

In the past year the individual models have been improved in various work packages. In work package three the NODUS model has been refined. The NODUS model is based on the concept of "virtual link" which is applied in a systematic way to model all transport operations: travelling, loading, unloading, transhipping, waiting, handling, paying tolls, etc. with several modes and means of transport. With this methodology and a suitable notation of virtual links and nodes, an appropriate algorithm in NODUS automatically generates a complete "virtual network" representing all transport activities and interfaces on extensive multimodal networks. This "virtual network" permits to solve problems of assignment to modes, means and routes over extensive networks in a single step. In the DSSITP project, the road, railroad and waterway network has been revised. Demand matrices have been extracted and updated. The value of time concept has been integrated in the cost functions of the model.

In work package four a discrete event simulation model (SIMBA) is constructed to analyze potential impacts of policy measures intended to stimulate intermodal barge transport. A conceptual model of the inland waterway network is defined and constructed in the simulation software Arena. The operations in the hinterland network of the port of Antwerp are modeled in detail to assess the impact on the network infrastructure and operational characteristics. Decision rules are defined to model the functioning of the locks. Also large efforts have been spent on the collection and preparation of the input data. The model logic has been finalized and tested

extensively. The SIMBA model is applied to estimate the impact of alternative hub scenarios in the port area of Antwerp. Four alternative hub scenarios are compared. A multihub scenario taking into account the specific structure of the port area seems the most promising with respect to potential reductions in turnaround time of inland shuttle services and potential capacity gains at sea terminals.
In a fifth work package the LAMBIT model is extended to include the railway network. Statistics from the NIS are updated and incorporated into the model. The LAMBIT model is a geographic information system (GIS)-based location analysis model for analysing the impacts of different policy options to stimulate intermodal transport. Based on the current market prices for each transport mode, the model compares intermodal transport with unimodal road transport. First a reference scenario for the terminal landscape is set up. Then different policy measures such as new terminal locations and subsidies are simulated by the model. A case study of the Narcon network has been simulated and analyzed. The simulations show that the terminal landscape is already very dense in Belgium and that potential new locations should be examined carefully in order not to cannabalise the market area of the existing ones. Additionally, the analysis of potential new locations for terminals underlines how important it is to have a broader view on the location of terminals and to take account of new initiatives. As for the price scenarios, the model indicates a need for subsidies both for rail and inland waterways transport. It shows that the market areas of rail terminals would not be able to survive without government subsidy. When similar aid schemes are directed to inland waterway transport, a growth in the market share for intermodal transport is achieved.

Finally integration between the models is realized and data share is detected. The combination of NODUS, LAMBIT and SIMBA can thus be considered as a top-down integrated framework, able to produce a useful insight of the intermodal chain. The application of the DSSITP framework is demonstrated by analysing two alternative policy measures. The first application introduces an optimally located additional barge terminal in the current multimodal network. A second analysis measures the impact of subsidy measures on the use of intermodal freight transport solutions. These two case studies are to be considered as examples of the use of the framework. The models can be used to analyse a broad range of other problems such as the evaluation of external costs related to intermodal transport, the impact of a new infrastructure or the analyses of alternative consolidation strategies in intermodal barge transport.

What we can conclude from the applications analysed so far, is first that the terminal landscape in Belgium is already quite dense and that it is difficult to find new interesting locations without disturbing the existing ones and with enough potential traffic. The current topology of existing terminals seems to be close to the optimal one. There may be some place for one, or maximum two, additional locations.

Second, subsidies can indeed help to increase the market share of intermodal transport. The current policy can significantly reduce the transhipment costs for the user, making intermodal transport much more attractive. However, one have to keep in mind that the current situation with a rail/road policy at the federal level, different inland waterways/road policies in the three regions and no coordination between these policies creates inefficiencies in the transport system. A coordinated policy, taking into account the locations of the intermodal terminals should be created. Also a coordinated policy in terms of spatial planning should be set up so that the location is being optimised from a broader perspective and not just decided on a local level. Indeed, intermodal transport can only be viable on medium or long distances, making region-only policies rapidly inefficient, at least at the Belgian scale. Moreover, Belgium can not be considered as an isolated area, because imports, exports and transits, for all modes, are very important.

We are convinced that intermodal transport remains one of the keys to improve sustainable freight mobility and that the further use of the DSSITP framework would help to assess new initiatives in the near future.