Cost and Strategies for Intermodal Transport between Eastern and Western Europe

Nikolaus Fries, IVT – ETH Zürich
Jost Wichser, IVT – ETH Zürich

Conference paper STRC 2006

STRC

6th Swiss Transport Research Conference
Monte Verità / Ascona, March 15. – 17. 2006

Cost and Strategies for Intermodal Transport between Eastern and Western Europe

Nikolaus Fries
IVT – ETH Zürich
Zürich, Switzerland

Phone: 044 63 33109
Fax: 044 63 31057
email: fries@ivt.baug.ethz.ch

Jost Wichser
IVT – ETH Zürich
Zürich, Switzerland

Phone: 044 63 33093
Fax: 044 63 31057
email: wichser@ivt.baug.ethz.ch

March 2006

Abstract

Intermodal transport becomes increasingly important on European west-east relations. In the context of a research project at the Institute for Transport Planning and Systems (ETH Zürich), this paper presents a market and cost analysis to determine the future potential of intermodal transport especially in the new EU member countries, where general conditions are harder than in the EU 15.

Cost and quality problems of intermodal transport are identified and solutions explained to overcome these problems. Resulting business, market and operational strategies can help each partner involved in the intermodal transport chain to implement the solutions and to operate successfully in this promising transport sector.

Keywords

Intermodal Transport – Rail Freight – Eastern European Markets – TEN – Terminal – Pre and Post Haulage

1. Introduction

1.1 Background

Rapid growth in trade caused by new economic development is expected to place increasing demands on transportation infrastructure and logistics management in Eastern Europe. This increased trade affects not only the ten European Union accession countries (2004) but also all of eastern and central Europe (including Romania, Bulgaria, the Balkans and members of the Russian Federation).

Eastern Europe's infrastructure is relatively undeveloped, and this has given rise to fears that trade growth will increase traffic congestion, logistic bottlenecks and environmental problems.

The purpose of this research project was first to identify the potential for increasing intermodal transport between Eastern and Western Europe by evaluating the current infrastructure network, legal framework, market conditions and cost structure and second to derive possible development strategies focussing on business, market and operation.

1.2 Methodology

The study methodology consisted of the following steps:

1. Evaluation of countries in central and Eastern Europe with the focus on market conditions, infrastructure and legal conditions;
2. Determination of the most promising transport relations between these countries and Western Europe (EU 15);
3. Detailed market and cost analysis for the resulting transport relations;
4. Identify potential business, market and operational strategies for sustainable development of intermodal transport on these relations.

The first part of the project (steps 1 and 2) –presented at the STRC in 2005 [1] – showed that the combination of two axes: the Southern Germany – Czech Republic – Southern Poland – Ukraine and the Switzerland – Austria – Hungary – Romania corridors (Axes D1/D2[1]) had the

[1] In the following assigned as Axis D.

best market conditions for intermodal transport. They link the highly productive regions of Southern Germany and Switzerland to the Czech Republic, Slovakia and Western Hungary (a region with a fast growing automotive industry) and further on to potential future EU members Rumania, Bulgaria and Turkey.

This paper presents the results of steps 3 and 4 of the project.

2. Market Potential and Transport Costs

2.1 Market Analysis

The decision to offer intermodal transportation in a given market critically depends on actual and/or potential freight transport volumes. An essential precondition for the successful implementation of intermodal services is to have sufficient potential transport volumes in both directions (including triangular relations, loops etc) in order to avoid empty wagon movements.

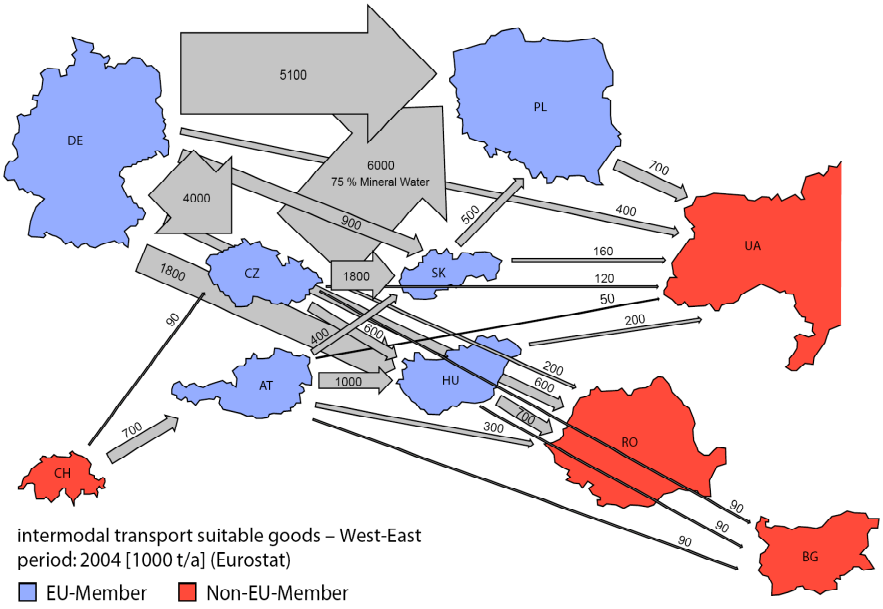
The foreign trade statistics for European Union member states from Eurostat[2] were used to analyze the status quo intermodal freight transportation between Western and Eastern Europe. The individual goods are classified in the combined nomenclature (CN), which is based on the international nomenclature of the harmonized system (HS) for the designation and coding of goods. The combined nomenclature (CN) consists of an eight-level organization of individual goods, which grew over the years from the different data systems (catalogs) of individual member states.

Figures 1 and 2 present the actual volume (year 2004 in thousands of tons) of freight suitable for intermodal transport between the countries related[3] to Axis D.

[2] EUROSTAT: the EU's statistical office

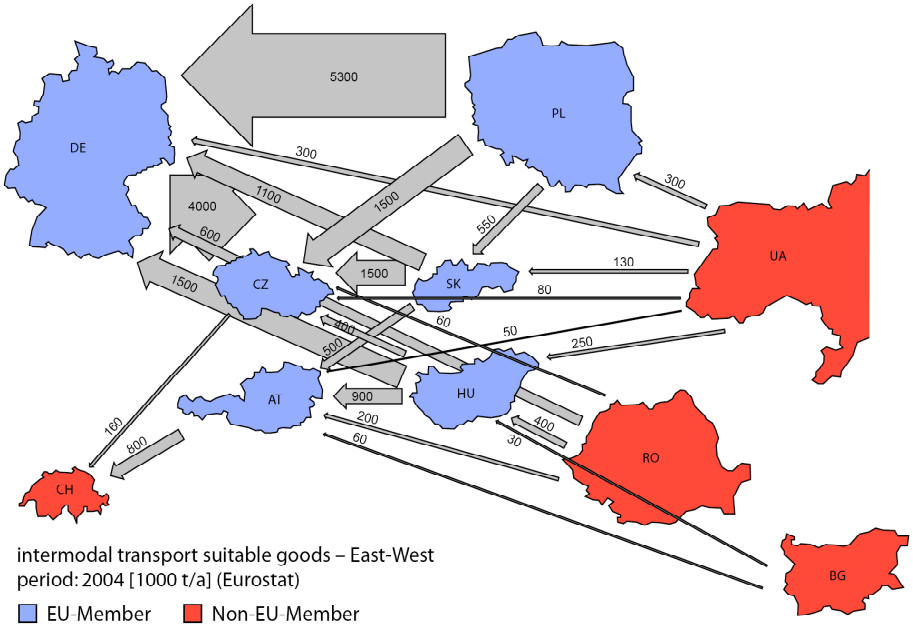
[3] The data for France are missing in these figures.

Figure 1 Potential volume for intermodal transport (direction west-east)



Source: Eurostat/IVT

Figure 2 Potential volume for intermodal transport (direction east-west)



Source: Eurostat/IVT

The transport volumes presented in the figures correspond to the actual transported freight tonnages for 2004, independent of transport modes. In estimating the market potential for intermodal transport, it is assumed that only a share of these goods could be moved by intermodal transport. This is because, in most cases, even when given shipments should (logically) be made by intermodal transport, it is often not worthwhile to use intermodal transport due to the lack of a network and/or inability to bundle shipments.

The transport volumes presented in Figures 1 and 2 must be considered approximate for the following reasons:

- The selection of goods categories that can be moved by intermodal transport differs depending on point of view and system definition. For this analysis we tried to make a realistic selection and, in case of doubt, did not include the goods category.
- The quality of the existing data varies with each individual EU member country, especially because they use slightly different methodologies for collecting data from surveyed companies. This means that commodity flows from only a certain number of "samples" are projected, and therefore the export value of a given country can be different from the corresponding import value of the other countries.

The determination of the future freight volume for intermodal transport is linked to an assumption for the modal split of the intra-European freight traffic and depends on economic growth in Europe. These factors must be considered in further analysis.

2.2 Cost Analysis

2.2.1 Scenario Overview

One of the main problems with intermodal transport is that it is not competitive with road transport on similar routes. The cost analysis completed as part of this research compares cost factors in the intermodal and road transport sectors to illustrate the disadvantages of and potential for intermodal transport in a growing and changing freight transport market.

The transport cost factors considered in this analysis depend on many parameters. Several parameters (e.g. tax regulations) depend on external conditions and cannot be directly influenced by the transportation sector. Furthermore, general conditions vary significantly between countries, which means that the values for cost factors can only be specified for the special cases. Therefore, for purposes of this analysis, a series of specific examples were created and considered under different scenarios.

Two analyses were completed: the first analysis (status quo analysis) considered existing costs and conditions, the second (prognosis) considered how total costs would change if specific assumptions or values of certain cost elements were to change (e.g. if fuel costs were to increase). This allowed us to better understand the influence of these factors on future demand for intermodal transport.

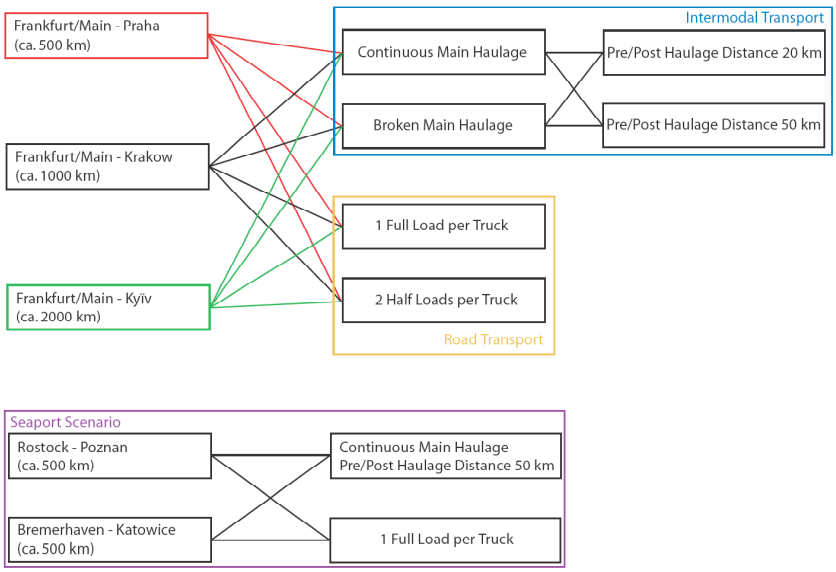
Finally, it should be understood that the specific values described below depend on the particular examples evaluated and therefore are not directly applicable to other routes. However, the overall results are believed to be descriptive of the general situation.

The analysis compared the door-to-door cost of making a shipment via intermodal transport (rail/road) and road-only transport for several different shipping scenarios. Since the single cost elements were calculated, the profit margins for the road hauler or the intermodal operator respectively must be added to calculate the forwarder's "all-in" price

The cost analysis considered two basic scenarios: first a haulage that required both pre and post haulage for the intermodal transport (by definition there is no pre and post haulage for the road-only transport mode), and second a haulage that only required post haulage for the intermodal alternative (i.e. containers could be directly loaded on to the train without being picked-up by truck; the example considered shipment from a seaport).

In summary, the study evaluated eight road-only transport scenarios and 14 intermodal transport scenarios (12 with pre and post haulage and two with only post haulage). Figure 3 provides an overview of the scenarios.

Figure 3 Scenario overview



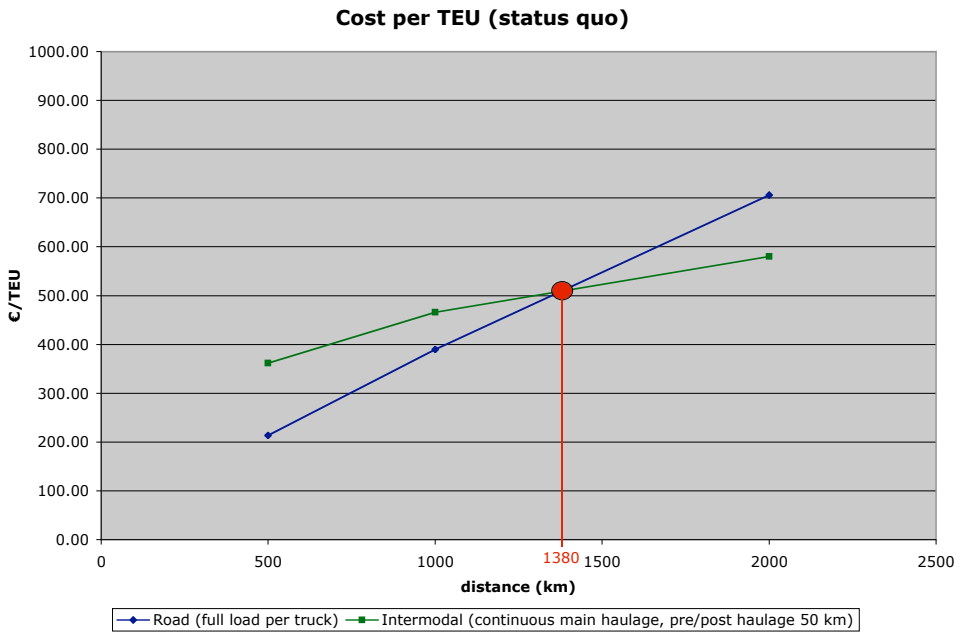
The cost analysis considers only operational costs. In other words it is assumed that the necessary investments in the infrastructure and the transport boxes (containers) have already been made. Furthermore, since the infrastructure for both road and intermodal transport (road and railway network, intermodal terminals) should be at least partly provided by the government, only the amortisation costs for rolling stock are included in the analysis. Thus, the analysis considers only specific costs depending on time, distance and transport units.

2.2.2 Status Quo Analysis

Once the costs for the example scenarios for shipments by road-only and intermodal transport were calculated the costs for various scenarios were plotted on a cost (per TEU[4]) versus distance graph. These graphs help provide a better understanding of the influence of the factors on intermodal transport's competitiveness with road-only transport.

Figure 4 compares the cost per TEU for road transport (truck full load) with intermodal transport (continuous main haulage between two large terminals with 50 km pre and post haulage distance).

Figure 4 Break-even Analysis – Status Quo



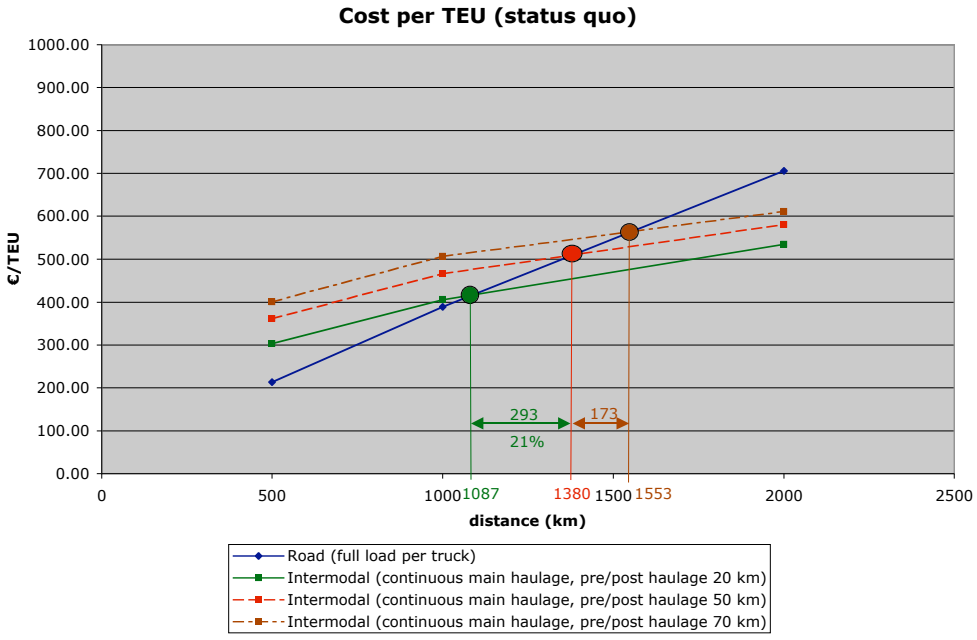
[4] Twenty Foot Equivalent Unit

Source: IVT

Figure 4 clearly illustrates the main difference between intermodal and road-only transport; intermodal transport has high fixed costs while road-only has high variable costs. Thus, as shown in the figure, over short distances the cost per TEU moved is higher for intermodal transport, and over longer distances the cost is higher for road-only transport. The figure shows that road-only costs rise faster than intermodal costs (the blue curve has a steeper gradient than the green one) and that transport costs are equal for both modes at about 1400 km. These results agree with actual conditions in central and Eastern Europe in that intermodal transport is not a serious competitor to road-only transport at distances less than 1000 km. Even on long distance routes of 1000 km, intermodal transport is almost 20% more expensive than the truck in road-only transport.

Figure 5 illustrates the impact of pre and post haulage on intermodal transport costs. In Figure 5 the green line represents the cost per TEU for intermodal transport with 20 km pre and post haulage distance, the red dashed line represents the 50 km pre and post haulage case (from Figure 4), while the brown dash-dotted line represents the 70 km pre and post haulage case. The blue line representing the road transport cost is unchanged from Figure 4.

Figure 5 Influence of Pre and Post Haulage Distance



Source: IVT

Figure 5 makes clear the importance of an optimised terminal location. Reducing the average distance between intermodal terminal and the customer by 30 km reduces the break-even point between road-only and intermodal transport by 293 km (or 21%) to approximately 1100 km. Taking 70 km as the reference distance, the difference to the 20 km distance is 466 km (or 30%).

Another important point to keep in mind is that pre and post haulage distances are not distributed evenly. If the terminal is situated inside an important commercial area with several clients in the direct neighbourhood, a large share of pre and post haulage relations can be shorter than the average distance. Thus it is possible to have routes with single clients based relatively far from the terminal without significantly increasing pre and post haulage costs. Pre and post haulage costs for intermodal transport can be significantly reduced by using intelligent tour management techniques to serve multiple clients with one truck.

2.2.3 Sensitivity Analysis

Once the status quo analysis was completed a sensitivity analysis was performed to test the impact of changes to three selected variables (fuel prices, wage costs, and road tolls) on the competitiveness of intermodal transport. Two scenarios were tested: a "Trend Scenario", which assumed that existing trends with respect to these variables would continue, and a "Maximum Scenario" which assumed that these trends would accelerate.

Under the "Trend Scenario" the following three changes were assumed:

1. Fuel prices increase by 50%;
2. Wage costs for road transport in the CEEC increase by 50%;
3. An EU-wide standard toll of 0,125 €/km is implemented.

These three changes were included in the Trend Scenario because they appear plausible under current conditions. Fuel prices are likely to increase. The current price of oil (approximately 60 US$ a barrel) is almost 50% higher than in 2004 – and this does not reflect the price volatility shown in the summer and hurricane season (2005) when oil prices rose to over 70 US$ per barrel. Most experts agree that oil prices will not decrease in the coming years.

Wage costs in the Central and Eastern European Countries (CEEC) are also likely to increase in the coming years. Wages in the CEEC have been stable for years, but rapid economic growth in these countries is expected to increase inflation rates creating upward pressure on wages.

Finally, it is likely that road toll systems will be implemented in the EU in the coming years. The urgent need to improve transportation infrastructure combined with increasing budget

deficits in several countries is forcing governments to look for alternative means of financing. Whether PPP models or other solutions are adopted, in any case policy makers are slowly moving towards the consensus that charges on the use of infrastructure are sensible microeconomic policy not only in the railway sector but also on the road sector.

The "maximum scenario" reflects the upper bound of how general conditions might change to favour intermodal transport within the next 10 to 15 years. Under the maximum scenario the following five changes were assumed:

1. Fuel prices increase by 100%;
2. Wage costs for road transport in the CEEC increase by 100%;
3. An EU-wide standard toll of 0,15 €/km is implemented;
4. Average speed on motorways decreases by 20%;
5. Operational performance in road transport decreases by 20% due to the lower average speed.

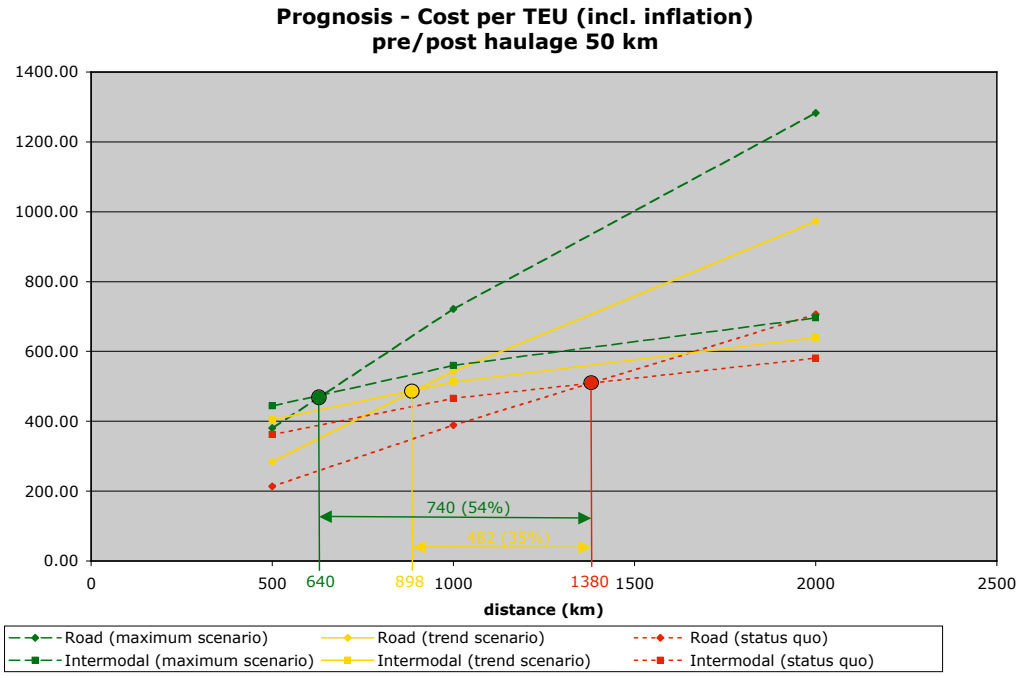
Points 1 to 3 are based on the assumptions of the "trend scenario" and reflect a possibly more rapid development of these trends.

The decrease in average motorway speed may be caused by an increasing congestion on the road network, especially in the EU 15 countries, because at a certain level of traffic, the existing infrastructure will not be able to handle any additional demand, and further capacity upgrades will be extremely difficult in many larger regions. Furthermore it is unlikely that infrastructure improvements in the CEEC countries will be able to keep up with the rapidly growing road transport demand – especially since there remains a significant backlog of improvements necessary in these countries.

Finally, in addition to the specific variables that were changed in the two sensitivity analyses, the costs of the other elements (i.e. those that were not specifically changed such as the wage cost) were adjusted upward to account for the impact of fuel price inflation. The fuel prices' impact on the other cost elements has been set to 5% for the trend scenario and 10% for the maximum scenario for all costs except electricity. The costs for electric energy were increased by 25% in the trend scenario and 50% in the maximum scenario, since the production of electric energy (or at least a considerable part of it) depends directly on mineral oil.

Figure 6 compares the road-only and intermodal transport costs versus distance under the maximum scenario (in green), the trend scenario (in yellow), and the status quo scenario – assuming continuous main haul and 50 km pre and post haulage for the intermodal alternative – (in red).

Figure 6 Prognosis with Pre and Post Haulage Distance 50 km

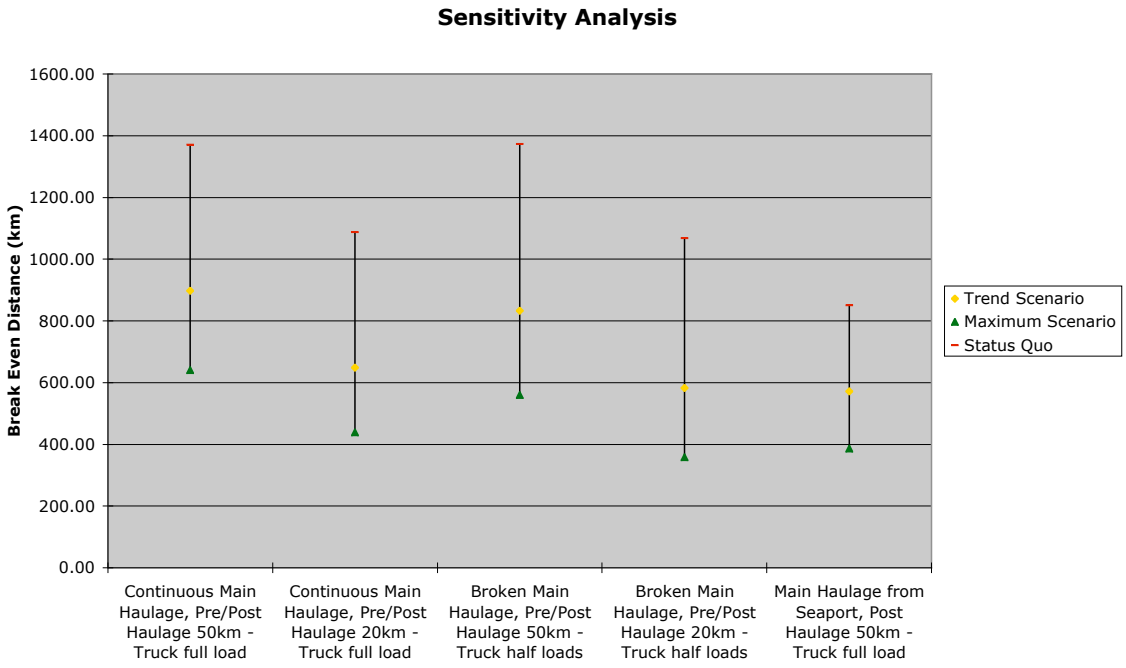


Source: IVT

As shown in Figure 6, the two sensitivity analysis scenarios show a significant decrease of the break-even distance. The break-even distance shifts from 1380 km in the status quo scenario to 898 km in the trend scenario (a reduction of 35%) and to 640 km under the maximum scenario (a reduction of 54%).

Figure 7 summarizes the impact of all variations of the status quo scenario and their behaviour under the impact of the two sensitivity analysis scenarios. For each variant it shows the break-even point in the status quo scenario, the trend and the maximum scenario.

Figure 7 Prognosis with Pre and Post Haulage Distance 50 km



Source: IVT

As shown in Figure 7, the trend and the maximum scenarios have a similar impact on the status quo variants reducing the break-even distance. In all cases except the seaport scenario variant this reduction is on the order of 650 – 700 km in the maximum scenario. The margin is slightly higher for the variant with broken main haulage and two half loads per truck. This may be because in that case the truck has to run an additional 100 km to serve the two different clients, which has significant consequences on the costs given elevated fuel prices and wage costs.

2.2.4 Conclusion

The analysis results (presented in the previous paragraphs) show that within the next 10 – 15 years intermodal transport has a good chance to become competitive on medium distance routes of 500 – 700 km. This means that on routes with high demand (e.g. Southern Germany – Slovakia/Western Hungary in the automotive sector) intermodal transport may be expected to show significant gains in market share.

However, it should be emphasized that this cost analysis has neglected the qualitative aspect of transport services. One reason is that quality criteria are difficult to integrate into the proper cost analysis; the other is the poor availability of data. When considering the results of this

cost analysis it is important to remember that today, in most cases, intermodal transport cannot meet the clients' quality requirements such as supply chains with just-in-time management. Several problems in the intermodal transport chain cause delays and prevent the operators from keeping the expected time window of delivery.

More specifically, if the intermodal transport cannot cope with the client's quality requirements, it will never be a competitive alternative even if the price is lower than for road transport.

Since the future scenarios evaluated in this analysis considered changes to variables that are not under the control of private transport operators (e.g. fuel prices, tolls), it will be up to the EU and national authorities to make the right decisions to increase the competitiveness of intermodal transport on long *and* medium distance routes.

3. Recommended Strategies

3.1 Major Problems in Intermodal Transport

From the customer's viewpoint intermodal transport is simply non-competitive with road transport on many potential relations. More specifically, in many potential markets

- Intermodal transport is **more expensive** than road transport;
- Intermodal transport **takes longer** than road transport;
- Intermodal transport is **less reliable** than road transport;
- Intermodal transport's service offer (routes, frequency) is insufficient to meet the customers' needs.

Therefore we have to distinguish between two main aspects:

- **Quality** (i.e. reliability and speed);
- **Coverage area** (i.e. number of service routes offered).

3.1.1 Quality

Quality problems exist in several parts of the intermodal transport chain and have different causes and consequences.

One aspect is that the intermodal transport chain is more complex if individual sub-processes are provided by **many independent companies** than if a single company manages the entire transport chain. This is because the more companies involved, the greater the number of sub-processes and external interfaces between sub-processes. Since each company will optimize every sub-process independently with the objective of its own maximal benefit, it is difficult or impossible to optimize the entire transport chain. Furthermore this structure results in **unclear responsibilities** towards the customer and between the partners themselves.

Therefore, reducing the number of (independent) operators may solve this aspect of the problem. The necessary minimum of operators should be integrated in a **hierarchical organization structure** to guarantee clear responsibilities between each of them and towards the customer.

Another aspect is the problem associated with **interfaces** between the single elements of the transport chains thereby increasing costs and reducing quality for the whole service. The **insufficient information transfer** between partners is one of the major negative effects

thereof. It can be avoided by introducing **uniform information interfaces** throughout the entire transport chain. This ensures that no vital information is lost or has to be re-entered into the information system of the receiving partner.

Finally the problems in the production processes (i.e. main haulage, pre and post haulage etc.) have to be mentioned. Concerning main haulage two problems not exclusively under the control of operators are **insufficient infrastructure capacity** and the **priority given to passenger trains**. They can only be solved with investments in rail freight infrastructure (**capacity upgrade**) and policy changes.

The pre and post haulage process is currently (in most cases) inefficient and cost intensive due to poor use of capacity, organizational problems and long distances. Improving the efficiency of the process can help to reduce cost and quality problems.

More generally, the great dilemma of intermodal transport is that **quality problems result in higher costs**. Therefore improving the quality of service helps to reduce production costs at the same time.

3.1.2 Network Building

In many cases a customers needs cannot be satisfied with the existing intermodal transport offer due to a fairly small number of existing intermodal transport routes. This problem can be addressed by creating new and/or denser intermodal networks.

The first step in building a network consists of connecting terminals that are operated by a single terminal operator. The second step, building up larger networks between different terminal operators, requires different operators to cooperate by handling shipments from other operators. Often terminal operators today are only willing to handle intermodal transport units (ITUs) from other operators if they have free capacity. They are not willing to invest in additional capacity (staff, cranes etc.) for third parties. This is a significant detriment to network building.

Today, most terminals are owned by railway companies or by their daughter companies. Also railway companies are in some cases shareholders of terminal operators. The foundation of daughter companies or the participation in stock corporations was performed in the era of the integrated state-owned railway companies. Today owners or shareholders are not the infrastructure companies, but the railway operating companies.

Intermodal terminals are generally not understood to be part of the transport infrastructure although they are sometimes publicly financed. However, in many European countries they are not financed as part of railway investment programs, but in separate programs for

intermodal transport. This is inconsistent since terminals perform the same interface function between transport modes as passenger railway stations.

We see that terminals must be part of the public infrastructure and thus should, at least partly, be financed by public means of investment (or public-private partnerships). The guarantee of free access to terminals, like free access to rail infrastructure, is a basic condition for network building. It is a task for EU (and national) legislation to create an appropriate legal framework.

With these preconditions we can also ask for international (public) coordination in terminal planning. A macroeconomic point of view is necessary to determine the optimal location for a terminal in terms of demand and efficiency, because private investors might put more weight on reaching certain clients of special importance to them. Therefore independent international organisations should be given the responsibility to determine or control the locations for new intermodal terminals.

3.1.3 Cooperation

In order to create competitive intermodal networks on an international scale, cooperation between several intermodal providers (and other partners involved in the transport chain) is essential. The basic preconditions for successful cooperation of two or more independent companies are:

- Similar business objectives;
- Reliability of partners;
- Medium/long term prospect for success.

The precondition of sharing the same business objectives can be a problem, if one partner competes with another in some other part of the transport business. A trucking company might, for example, prefer to transport an ITU over the entire distance rather than be a partner in an intermodal transport chain. Therefore, to avoid this problem, the number of partners involved should be reduced to a necessary minimum and organized in a clear hierarchical structure (see chapter 3.1.1).

The problem of unreliable partners has to be overcome by contract penalties. Contract penalties can be an effective way of assuring contracting partners' reliability and quality, if responsibilities are clearly defined in the whole transport chain. If one partner's commitments are not clearly expressed in the contract, the ability to demand penalties in case of unreliability is low.

In most cases reliable prospects for long-term profit are unrealistic due to uncertain demand forecasts. Since intermodal transport requires large investments (e.g. in terminal infrastructure and rolling stock), high financial risks arise for the partners, if returns of investment cannot be guaranteed. A possible solution is sharing the investment risks between several partners and public authorities (e.g. public-private partnerships for constructing and operating terminals or direct subsidies to private investments).

3.2 Business Strategies

Based on the problem analysis a number of business strategies for each partner of the intermodal transport chain could be derived.

3.2.1 Single Provider Strategy

Given the cost, coordination, and quality problems with the existing intermodal transport system, the optimal strategy would be for a single company to manage the whole process and to provide door-to-door freight transport service.

In most cases, where the main haulage between terminals must be provided by more than one railway company and/or the origin and destination terminals are not operated by a single company, this business model is hard to realise. The reason could be the lack of a dominant partner (in other words no company stands to gain a significant benefit from working together to create a seamless system for the customer).

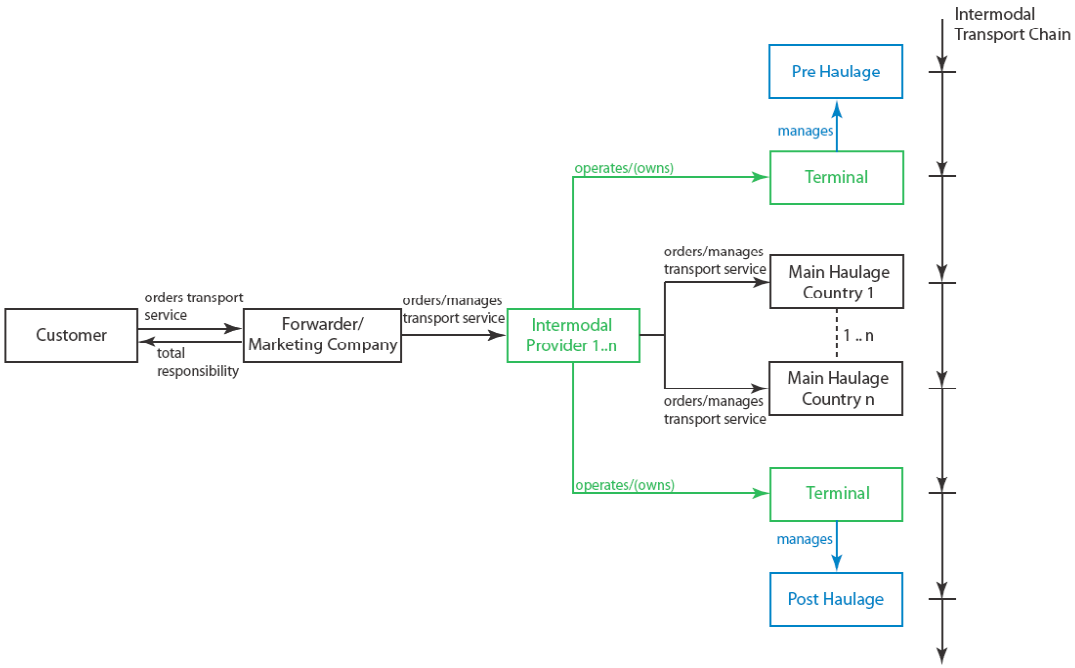
3.2.2 Multiple Provider Strategy

Until single companies can have more control of the entire intermodal process, the most realistic strategy to pursue is to minimise the impact of interfaces in the transport chain. This strategy consists of:

- Better coordinating the operation of terminals with pre- and post-haulage, and
- Having intermodal providers manage the main haulage connections between terminals.

The first of these is a matter that can be directly addressed by various different partners in the transport chain. The second is already allowed as part of Open Access Regulations throughout the EU and the candidate countries, which leaves terminal operators free to choose the best railway operators for connections from terminal to terminal.

Figure 8 Operation model with intermodal provider and forwarder



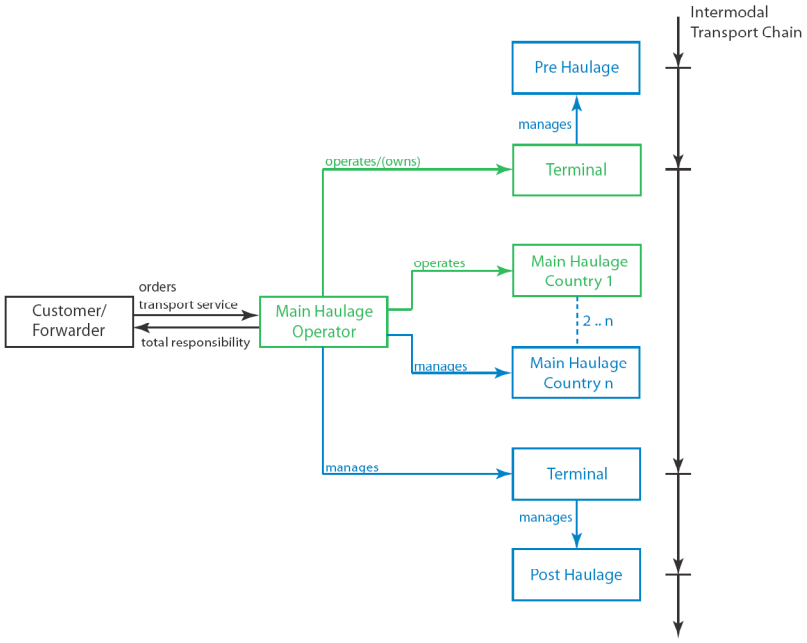
Source: IVT

3.2.3 Alternative Strategies

There are several alternatives to a multiple provider organisation of the intermodal transport chain, which can also exist in combination among each other. As an example Figure 9 illustrates the alternative of one railway company providing the main haulage and thus taking on the role of intermodal operator.

This strategy allows a more sophisticated quality management, because in the optimal case of continuous main haulage the main haulage operator manages the complete transport chain from terminal to terminal without any subcontractor (or even from door to door including pre and post haulage). He contracts with a forwarder or directly with the customer.

Figure 9 Operation model with main haulage operator as an integrator



Source: IVT

3.3 Market Strategy

The best market strategy varies for each type of company involved in the intermodal transport chain (e.g. forwarder, main-haulage operator, pre- and post-haulage operator, terminal operator) and must be chosen according to the company's general business strategy.

Based on the corridor considered in this analysis (Axis D), generally speaking the best strategy is a combination of axis and area-wide oriented transport offers. The lower market share for intermodal transport on short and medium distances means that, within the EU, only a few relations will have high enough freight volumes to justify regular direct train links.

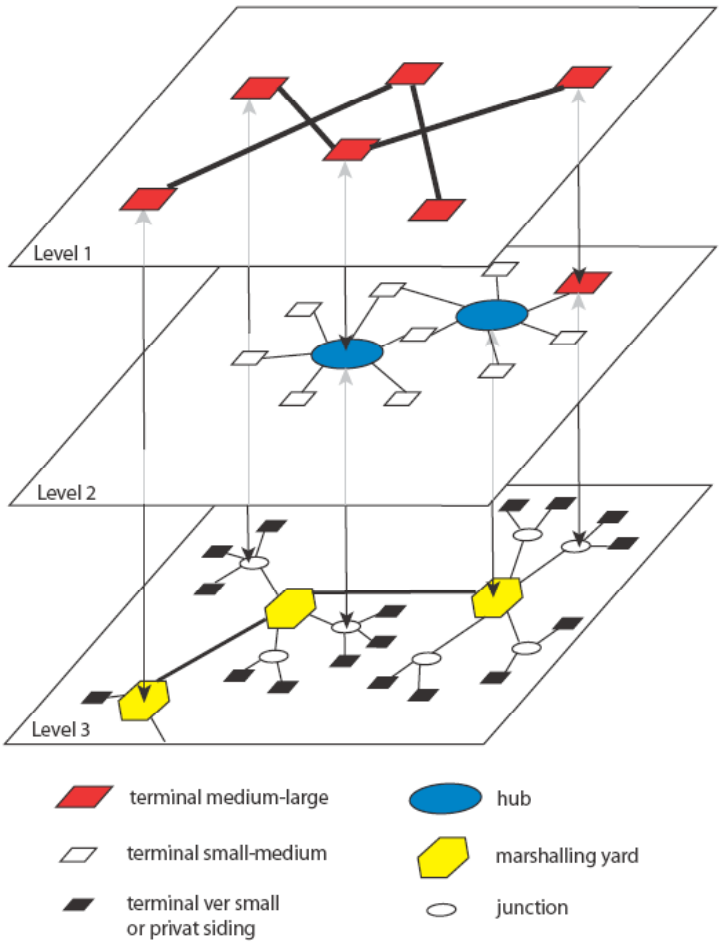
As a consequence, it is necessary to combine different commodity flows efficiently on the main haulage network. The recommendation is to combine goods flows from several less important relationships on to a core network, which is designed based on the high potential transport relations. The principal nodes on this network can be used as the base points to create several regional networks designed to provide service to areas of medium and low demand.

In case a single operator is not capable of operating a proper network by itself and prefers to focus on a single axis strategy, it is essential for the operator to cooperate with other operators to link several axes and regions into an integrated network.

3.4 Operational Strategy

The proposed strategy for the main haulage process in intermodal transport can be displayed as an integrated model – a hierarchical system divided in three levels of service as illustrated in Figure 10.

Figure 10 Hierarchical model for intermodal transport services



Source: IVT

The first and second level represents the proposed intermodal network comprising a principal (or core) network and several regional networks. Level 3 represents the option of integrating intermodal transport in existing networks for wagonload transport.

Level 1 covers the principal network on a multinational scale. Since the analysis is based on a set of international axes connecting Western and Eastern Europe, these axes form the basic structure of the network. High potential axes running in orthogonal direction provide the interconnections necessary for a proper network structure.

The connecting points represent the central intermodal hubs between which regular direct trains guarantee a constant high level of service and quality. Theses direct trains may either be shuttle trains (in case of paired and continuous commodity flows) or block trains (in case of grouped feeder services or unpaired commodity flows).

Level 2 represents a number of regional networks structured around the central hubs of the principal network. Those networks serve to achieve a higher coverage of the market in order to operate the core network at higher capacity. Normally regional networks will not offer international services because of their mostly national service areas, although there may be some exceptions on certain high potential direct interconnections between two regional networks (without using the principal network).

Since regional networks cannot be operated with direct train services, average speeds are lower and operation is less cost efficient than on level 1. Operation modes are normally mixed, based on a hub and spoke or liner trains structure; this depends on each network's general conditions.

Level 3 is an appropriate additional solution for all transport flows that cannot be handled with dedicated intermodal services and for private sidings. The quality is lower than on the first two levels, because transport times are longer and operational costs are higher.

The strategy is to operate the existing wagonload networks as before but with additional transport volume generated by intermodal offers. This makes it possible to run more direct trains meaning less marshalling. Intermodal hubs, marshalling yards or junctions may serve as connecting points to the intermodal network (levels 1 and 2).

4. Conclusion

Since the EU enlargement in 2004, intermodal transport has become increasingly important especially on international east-west routes. This research project analysed the actual conditions for the intermodal transport sector and developed strategies for its sustainable long-term development.

The research project's analysis of current market conditions, transport infrastructure and legal structure in the Central and Eastern European Countries (CEEC) showed that, out of 6 relations analysed in detail, Axis D (see chapter 1.1) would be the most promising corridor for extended or new intermodal transport services. The actual potential is estimated to 2 trains per day (5 days per week) for the corridor Western Germany (Ruhr area) to Western Hungary.

A problem is that intermodal transport is uncompetitive economically compared with direct road transport for distances less than 1400 km. In order to strengthen intermodal demand, efforts must be made to optimize the intermodal transport chain and its internal processes as well as in legislation to reduce the intermodal-truck only transport cost break-even point to a maximum of 1000 km, the range within which most high potential relations currently lie.

Today, intermodal transport is not only more expensive, but also slower and less reliable than road transport. Existing problems in the intermodal transport chain must be eliminated to provide better quality and a higher level of service, thereby helping to reduce costs.

To improve quality the number of operators should be minimized and operators should be organized in a hierarchical structure. Uniform information interfaces between the partners should be used to help reduce time and cost due to inefficient information transfer. The efficiency and reliability of each process of the transport chain (pre and post haulage, terminal handling, main haulage) must be increased.

Network building can help increase the coverage area and lead to a higher level of service. Public financing of terminal infrastructure and liberalizing legal conditions should encourage private investors and operators to offer more intermodal transport service. In order to establish powerful international networks, different providers should cooperate with each other to link regional networks and to share high investment risks (e.g. construction of terminals).

Aligning the business, market and operational strategies (see chapters 3.2 – 3.4) of all partners involved in the intermodal transport chain will help to achieve these goals. If the private sector and public decision makers implement the strategies recommended in this research project, it will be possible to make substantial progress towards the sustainable development of intermodal transport and thus to reach the EU's goal of shifting freight transport from road to rail as formulated in the EU White Paper [2].

References

[1] S. Besters, J. Wichser, U. Weidmann: "Elaboration of East-West Market Development Strategies for Intermodal Transport", Conference Paper STRC 2005

[2] European Commission: White Paper "European transport policy for 2010: time to decide", Luxembourg, 2001

[3] European Commission: European energy and transport trends to 2030, Luxembourg, January 2003

[4] Eurostat: Foreign trade statistics, http://epp.eurostat.cec.eu.int, 2005

[5] R. Hubauer: "DCUS-Modul-Terminal-Konzept", hubauer heavy weight logistics GmbH, Linz, May 2005

[6] IVT – ETH Zürich: "Operating Forms for Network Modes", Final Work Package Report for WP 1.4 of the EU Project "IMPULSE", June 1997