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# INTERMODAL TRANSPORT IN EUROPE - OPPORTUNITIES THROUGH INNOVATION

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**ABSTRACT. Background:** Freight transport volume in ton-km in OECD countries will grow considerably up to 150 to 230 % in 2050 compared to 2010. Although the EU policy aims to shift 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030 the recent trends show a stable modal split of road at approx. 75%. Conventional intermodal transport on the major European routes has shown a steady but only limited organic growth through recent years. Therefore, new innovative concepts for intermodal transport and for the shift from road to rail are needed.

**Methods:** Definitions of intermodal transport have been clarified and the development of combined transport in Europe and in Germany and Poland in particular has been analyzed on the basis of available data sources. New innovative concepts for intermodal transport have been identified on the basis of desk research, recent relevant projects (RETRACK, SCANDRIA, Rail Baltica) and market intelligence.

**Results:** The analysis leads to the conclusion that new innovative concepts in intermodal transport comprise new forms of organization as well as new technologies and new routes. The following three innovations to facilitate the shift from road to rail by intermodal transport are being introduced and discussed: multimodal operation of ocean carriers in maritime hinterland transportation, innovative handling technologies for non-crane able trainers and freight corridors for long distance intermodal transport within the TEN-T network and on the Europe-Asia corridor.

**Conclusions:** Further accelerated growth in the shift from road to rail through intermodal transport requires new innovative concepts beyond the traditional combined transport in Western Europe. Three promising innovative concepts have been introduced. Further research is needed and should be focused on financial and economic appraisal as well as on the effectiveness of state intervention policies.

**Key words:** Intermodal Transport Markets, Multimodal Transport, Combined Transport; Freight Corridors, Container Transport, Non-crane able trailers, Innovation.

## INTRODUCTION

Forecasts for freight transport show that freight transport and road transport in particular will grow considerably. In OECD countries freight transport volume in tonne-km will grow up to 150 to 230 % in 2050 compared to 2010, in Non-OECD countries up to 250 to 550 % in the same period. (OECD / ITF, 2012, p. 8) According to OECD / ITF [2012] the general trend may be towards a higher share in use of road vehicles since this provides for more flexibility in terms of delivery and uses relatively cheaper infrastructure than rail.

Considering the bottlenecks in road infrastructure existing already today and the ecological impacts of transport, ever increasing road transport is seen critically and calls for a wider use of rail and ship on the main haul and in combined transport solutions. But recent statistics according to (European Commission, 2013, p. 110) show no real turn but a stable share of road transport of approx. 75% in the modal split in EU - 27 countries [European Commission, 2013]. For


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comparison: In Germany the share of road transport in land freight transport in tonne-km was 67% in 2001, 65% in 2010 and 66% in 2011, while in Poland the road transport share was 62%, 81% and 79% in the same periods [European Commission, 2013].

Accordingly an actual objective of the European Union transport policy is to shift 30% of road freight over 300 km to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors [European Commission, 2011]. "In longer distances, options for road decarbonisation are more limited, and freight multimodality has to become economically attractive for shippers. Efficient co-modality is needed. The EU needs specially developed freight corridors optimised in terms of energy use and emissions, minimising environmental impacts, but also attractive for their reliability, limited congestion and low operating and administrative costs" [(European Commission, 2011].

Intermodal transport solutions which combine and use all modes optimally can contribute significantly to higher efficiency and attractiveness of the overall transport system and to the ease of the road infrastructure. Measures to support intermodal transport are consistent with the EU policy, which aims to strengthen combined transport in Europe and to establish green transport corridors [The Federal Government, 2008].

## INTERMODAL TRANSPORT - DEFINITIONS AND MARKETS

In order to clarify the variety of different terms the following definitions will be used in the further course of this paper:

Intermodal Transport is "the movement of goods in one and the same loading unit or road vehicle, which uses successively two or more modes of transport without handling the goods themselves in changing modes" [UN ECE, 2001]. Loading units are intermodal transport units as containers, swap bodies and crane able semi-trailers. Combined Transport is a sub-category of this term and "is an intermodal transport where the major part of the European journey is by rail, inland waterways or sea and any initial and/or final legs carried out by road are as short as possible." Combined transport is therefore used, when road transport is substituted by rail or ship on parts of the transport route [UN ECE, 2001]. Combined transport can be accompanied transport (e.g. complete motor vehicles with drivers on low-floor railcars as rolling motorway or on ferries) or unaccompanied transport (loading units on rail or ship).

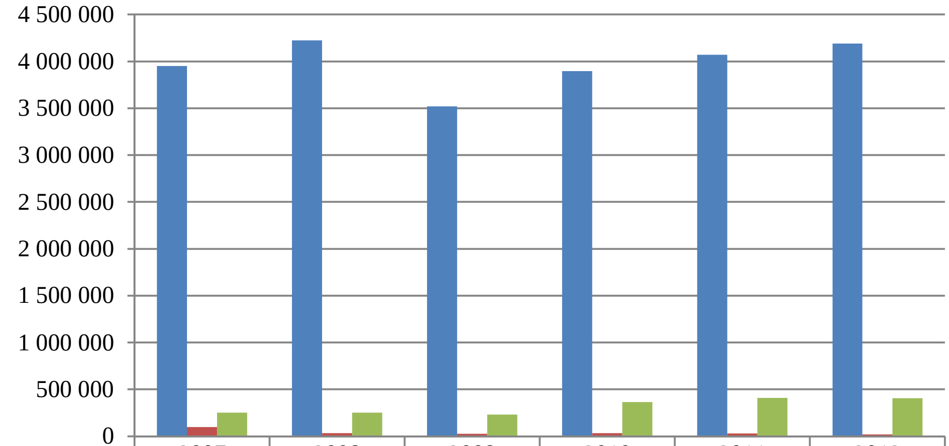
Different from these technical terms the term "Multimodal Transport" is a legal term and is used for "the door-to-door movement of goods under the responsibility of a single transport operator known as a Multimodal Transport Operator (MTO) on one transport document." [UNCTAD, 2014] Provisions for Multimodal transport documents came into force in 1992 [UNCTAD, 1992]. Multimodal documents are the FIATA Bill of Lading or the MULTIDOC 95 and serve as documents of title and are bankable in documentary credits. If the terms of payments require documentary credits, exporters using multimodal documents may benefit from earlier payment and decreasing capital costs. In this case the point of delivery may be shifted from ports to inland points, e.g. if the term of delivery "FCA Free Carrier" (inland terminal) and a FIATA Bill of Lading is agreed upon as bankable document.

From the definitions it can be derived that not every intermodal transport needs to be a multimodal transport, e.g. a door-to-door container transport can be covered by several segmented contracts. Actually in Continental Europe the share of door-to-door- contracts in seaborne container transport (i.e. carriers' haulage contracts) can be estimated at 20 % to 30% only. Merchant haulage documents for the pre- and on carriage and a separate port-to-port-bill of lading issued by the ocean carrier for the sea leg prevail. Also multimodal transport needs not to be intermodal, in case no loading units are being used (e.g. heavy lifts and project cargo).

*Intermodal markets*

We can distinguish between two major intermodal markets. One is the seaborne trade and its corresponding pre- and on-carriage from and to the seaports hinterland. Here the ISO maritime containers owned or leased by ocean carriers prevail. The second market is the continental intermodal transport of unaccompanied crane able semi-trailers and swap bodies owned by forwarders. In this continental market on longer distances also ISO maritime containers and "Euro-pallet-wide" containers are applied, usually provided by railways or leasing companies. Accompanied semitrailers with trucks are carried on special flat railcars by so-called "rolling motorways". They play nowadays a niche role in case of road traffic restrictions only.

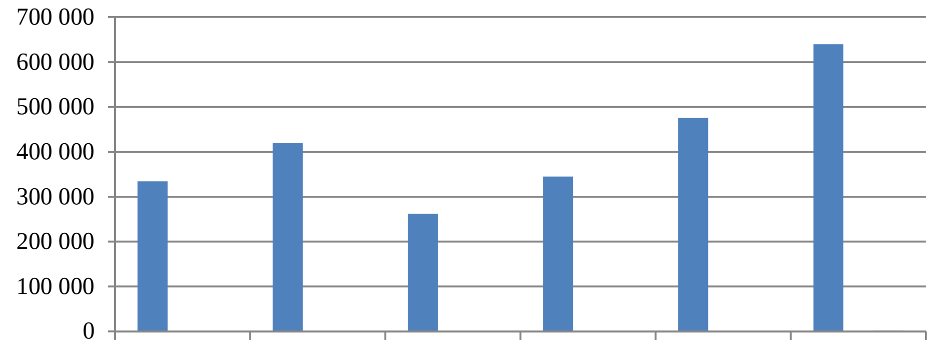
Table 1. Annual number of empty and loaded intermodal transport units carried on railways in FR Germany
Tabela 1. Ilość pustych i pełnych jednostek transport intermodalnego zrealizowanych przez koleje FR Germany




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| containers and swap bodies | 3 952 433 | 4 223 321 | 3 518 950 | 3 895 724 | 4 069 957 | 4 191 420 |
| road vehicles (accompanied) | 95 881 | 33 489 | 26 962 | 31 758 | 29 422 | 19 327 |
| semi-trailers (unaccompanied) | 249 808 | 253 041 | 230 636 | 365 472 | 410 077 | 403 739 |

Source: Eurostat, 2014

Table 2. Annual number of empty and loaded intermodal transport units carried on railways in Poland
Tabela 2. Ilość pustych i pełnych jednostek transport intermodalnego zrealizowanych przez oleje w Polsce




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| containers and swap bodies | 333 835 | 419 285 | 261 787 | 344 538 | 475 460 | 639 936 |
| road vehicles (accompanied) | 0 | 12 | 2 | 7 | 7 | 1 |
| semi-trailers (unaccompanied) | 0 | 0 | 1 | 30 | 109 | 2 004 |

Source: Eurostat, 2014

Concerning intermodal transport by rail in Germany the table illustrates that containers and swap bodies dominate the market with approx. 90% share of all loading units. The development trend of containers and swap bodies shows a modest growth only what can be explained by the high level of containerization achieved already. Nowadays shipping lines offer more than 30 types of containers for almost every type of commodity.

The combined transport of accompanied road vehicles shows a negative trend. Rolling motorways were successful in Alp crossing traffics and through state interventions only.

Slow but continuous growth in combined transport of semi-trailers in Germany is an indicator for further potentials in this segment.

In Poland the development of intermodal transport is in a development phase and much more dynamic.

The container traffic by rail almost doubled between 2007 and 2012. This is a sign of the increasing container traffic via Polish ports on-carried to the industrial hinterlands in Poland. The combined transport of accompanied road vehicles plays no role whereas the combined transport of unaccompanied semi-trailers is in its initial phase.

Considering all European Union (28) countries a steady but modest growth of intermodal transport of 3.7 per cent per annum can be observed between 2004 and 2012. (calculated according to [Eurostat, 2014]) In order to achieve the EU policies objectives through better co-modality of all modes of transport in general and by strengthening intermodal transport in particular, innovations - additionally to the organic growth - are needed: new organizational concepts, new technologies and new routes with new intermodal products. Although national and EU transport policy may support these innovations in their initial phase, in the longer run they need to be competitive without state subsidies. Innovation trends will be introduced for the seaborne as well as for the continental intermodal markets in the following.

## SEABORNE CONTAINER TRANSPORT: ECONOMIES OF SCALE AND MULTIMODALITY

*Containerization is a sea battle, fought and won ashore.*

Although since 2008 there are signs of maturation of container traffic [Rodrigue, 2014] there is still room for organic growth. Because up to two third of costs in container transport are caused by landside operations, the hinterland transport is a major playing field for rationalization and growth. The following trends shall be discussed in brief:

*Hinterland hubs*

Ever bigger ships are the main factor for ports to look for opportunities to ensure fast and flexible terminal handling within limited time windows. To establish hinterland terminals and hubs which serve as centres for sorting, consolidation and distribution of containers and railcars is one strategy which is followed by terminal operators and container carriers [Brügelmann, 2012]. Frequent container shuttle trains between port and hinterland hub facilitate intermodal transport.

*Hinterland distribution centres*

Although there are no reliable statistics available there are indications that the share of containers stuffed or stripped in ports is still very high because ports often function as consolidation and distribution centres for overseas commodities. 57 % of all containers imported via Port of Hamburg and on-carried by trucks stay in the city of Hamburg or in the surrounding region [DESTATIS, 2014]. Very often the reason is that the container cargo is stripped and stored in distribution centres within this region and delivered according to demand later to the final points of destination within Germany and Europe as conventional truck load. These long traditions in supply chains are questioned more and more as availability and costs of labour force and of real estate have become more challenging in port regions during recent years. The shift of European and regional distribution centres into hinterland is a trend which could be observed in the Netherlands first (concept of Distriparks) and is gaining importance in Germany also (e.g. in Berlin-Brandenburg region [Wagener, 2008]). This trend strengthens the shift from conventional cargo on trucks towards containers on rail.

*When will sea carriers go really multimodal*?

Considering the low level of carriers pre- and on-carriage in maritime containers' hinterland traffic the question may be raised why sea carriers tend to deploy their containers on the sea leg only and why they are reluctant to act as a Multimodal Operator who would integrate the land leg into a full service package. As major reasons may be considered:

- the focus of vessel owning ocean carriers on high market shares in ocean transport and on selling container vessels capacity,
- the strong market position of seaborne forwarders as 3PL (3PL = Third Party Logistics Provider, i.e. logistics provider which organizes the logistics chain on behalf of the shipper but does not own transport equipment necessarily) which organize the logistics chain on behalf of the shippers and which benefit from organizing hinterland carriage,
- the imbalances of container flows and the sophisticated container logistics necessary in the case of controlling hinterland transport,
- the investments into a hinterland system and into assets which would be necessary in the case of establishing a real multimodal system (including terminals, depots, dedicated shuttle trains, forwarding services, etc.).

On the other hand there are arguments for the engagement of ocean carriers in hinterland traffic as real Multimodal Transport Operators. Reasons among others are:

- the possibility to control hinterland routes and to direct container flows to certain hub ports instead of the need to pick up cargo in several ports. Economy of scale in ocean shipping can cross-subsidize increasing inland transport costs because of fewer ports served. Examples are grid tariffs and port equalization schemes applied by ocean carriers in inland tariffs [Biebig, et al., 2008].
- the direct contact to major industrial shippers and the possibility to generate the sea freight necessary without the influence of intermediaries.
- a possible control and higher productivity in container logistics hence often for sales reasons empty containers are positioned to the hinterland free of charge, even in the case of merchant haulage.

Indeed there are signs that major shipping lines tend to establish an inland terminal network (owned, partner, joint venture) stepwise and to offer genuine door-to-door-multimodal transport. The result is a higher concentration of container volumes on certain hinterland routes, in control of the ocean carriers and a corresponding higher share of rail and barge transport. This results in lower pre-and on-carriage costs per rail in comparison to single truck loads. An example is the intermodal split in the Rotterdam hinterland traffic of the Maersk shipping line. In the case of merchant haulage the split is 65 % truck, 27% barge and 9% rail whereas the intermodal split in the case of carriers' haulage is 25 % truck only, 42 % barge and 32 % rail [Gibson, 2008]. We can assume that a higher share of carriers' haulage will contribute to the shift from road to rail decisively. The ever increasing ships' sizes and the cost pressure are the driving forces for ocean carriers to exploit productivity potentials still existing in the hinterland through comprehensive control of container logistics and the use of high capacity and low costs shuttle trains and barge services to and from inland hubs.

## CONTINENTAL INTERMODAL TRANSPORT: INNOVATIVE TECHNOLOGIES FOR NON-CRANE ABLE TRAILERS

Continental road transport is dominated by semi-trailers, carrying 66 % of the transport volume. But only 2 % of these semi-trailers are equipped for vertical handling and can be used for unaccompanied intermodal transport.

Overall at present only 15% of all road units (semi-trailers, containers, swapbodies etc.) can participate in the unaccompanied intermodal transport [Teßmann, 2012].

A new intermodal product based on a technology for handling and transportation of non-crane able semitrailers would open the huge market of rail transport for conventional semi-trailers which are by far prevailing, especially in the Eastern and Southern European countries. Quite a variety of innovative technologies have been developed during the last years, but almost none could exceed pilot stage or was fit for the market. Also the rolling motorway for rail transportation of accompanied trucks and trailers could survive in niche markets and with state interventions only. But with the expanding distances within the new EU (28) countries, with increasing costs of road transport and with the pressure to reduce greenhouse emissions the need for technological innovations in rail transport which adapts railcars and terminals better to the needs of their potential clients in road transportation is ever growing.

Indeed now several innovative technologies are ready for market entry or are implemented already. Without being comprehensive the following technologies for handling and unaccompanied rail transport of non-crane able trailers shall be mentioned in brief (in alphabetical order):

- Cargo-Beamer: pulls crane able trays with semi-trailers on special wagons. Trays can be loaded vertically by conventional cranes or reach stackers or horizontally on special terminals. Pilot connections are implemented in Germany.
- ISU: semi-trailer is lifted with additional spreader vertically into pocket wagon. The ISU-technology is implemented as a bridge technology for low volume traffic.
- MegaSwing: is a rotatable and moveable waggon, needs no special terminal, only electric supply. Pilot trains were successful.
- Mobiler: special loading unit is pulled from truck on the wagon horizontally. The Mobiler technology is used for in house industrial shuttle connections.
- Modalohr: semi-trailers on low floor and articulated wagon, special terminals needed. The Modalohr-system has been implemented in high volume, special shuttle train connections successfully.

A recent study compared different technologies by a multi-criteria analysis for their application within the North-South corridor via the German capital region Berlin-Brandenburg [Wagener&Herbst Management Consultants GmbH, 2013]. Which technology is fitted most for a certain market depends on the type and volume of traffic mainly. For the initial low volume phase the ISU technology is appropriate. MegaSwing and Cargo Beamer can serve both low volume and high volume trades, also in mixed trains. The Modalohr-system is efficient in particular in long distance high volume trades with special shuttle trains and special terminals. The Modalohr system has been working since 2003 on the 175 km Autoroute Ferroviaire Alpine (AFA) between France and Italy with 5 trains daily and since 2007 on the 1,050 km route between Luxembourg and Perpignan (Southern France) with up to 4 trains daily [Metz, 2014].

A comparison between the combined transportation of crane able semi-trailers and the transportation of non-crane able semitrailers showed that the conventional unaccompanied combined transport of crane able semitrailers can offer lower total system costs. On the relation Cologne - Milano (825 km) the total system costs for conventional combined transport were 580 € per semi-trailer and for the second best, the Modalohr system 759 € per semi-trailer [Mertel, 2013]. But to assume that the innovative horizontal technologies are not competitive would be a too far going conclusion. Actually, there seems to be a hen and egg problem. The conventional combined transport operators are ready to open a regular service if there is no risk of utilization. Therefore private company trains are preferred since there is no risk for the operator at all. The small amount of crane able semitrailers makes it difficult for the operators to start a public train unless there is a high demand already, often caused by traffic limitations (e.g. in the Alp crossing traffic). Because of the much higher market share of non-crane able semitrailers the risk for operators for this type of trailers can be considered as much lower. Indeed the experiences of the Autoroute Ferroviaire Alpine (AFA) with the Modalohr system between Aiton (F) and Orbassano (I) via the Mont Cenis tunnel show that since 2003 more than 200,000 semi-trailers have been carried successfully and that after an extension of the gauge in 2012 to GB 1 the possible carriage of 4 m corner height trailers caused a significant increase of this type of trailer to 50% of the total amount. Interestingly there was no single crane able semitrailer on these trains [Metz, 2014].

Obviously the new technologies serve a different market and do not cannibalize the conventional combined transport. A stated preference survey among forwarders and road carriers showed that road carriers would be willing to adjust their business model to horizontal loading technologies on the one hand but are reluctant to leave their semi-trailers out of their control on the other hand [Truschkin, 2013]. Because transport costs beside punctuality and reliability are the most important factor for the modal choice, pricing instruments are considered as the most effective means to promote the shift of non-crane able semi-trailers from road to rail [Truschkin, 2013].

For the implementation of a high volume intermodal system for non-crane able semi-trailers the following success factors can be considered as important:

- shuttle trains over long distances with high frequencies,
- investments into infrastructure, availability of sufficient rail time table capacity and clearance from technical barriers in order to ensure standard gauge G1or G2,
- available base load in the initial phase,
- strict neutral operator with a full service package (optional pre- and on-carriage),
- financial capability of the operator to overcome initial phase,
- full control and real time information e.g. through GPS based telematics solutions,
- punctuality and reliability of train services
- competitive price in comparison to road transport,
- complementary state intervention, e.g. through toll fees or traffic limitations in environmentally sensitive areas.

## SERVING ALL: FREIGHT CORRIDORS FOR LONG DISTANCE INTERMODAL TRANSPORT

Because of additional loading and unloading costs at transhipment points between road and rail or ship, the intermodal transport requires an economic minimum distance between two transhipment terminals. Depending on the operational concept this minimum distance is regarded as between 300 and 500 km, a distance roughly above a day-trucking. In principle the longer the rail route the more competitive intermodal transport becomes against pure road transport.

But over longer distances obstacles in the interoperability of national rail systems hamper the long distance intermodal transport and are therefore a major action field for the EU transport policy. The regulatory framework for establishing interoperable and efficient rail corridors between EU member countries and third countries was established with the EU Regulation No. 913/2010 [European Commission, 2010]. For important rail freight corridors executive and management boards were established to coordinate freight corridor implementation plans which among others include co-ordination of investments and traffic management provisions.

The Alp crossing route between ARA (Antwerpen, Rotterdam, Amsterdam) ports via Germany to Italy is the most important route for intermodal rail transport in the EU.

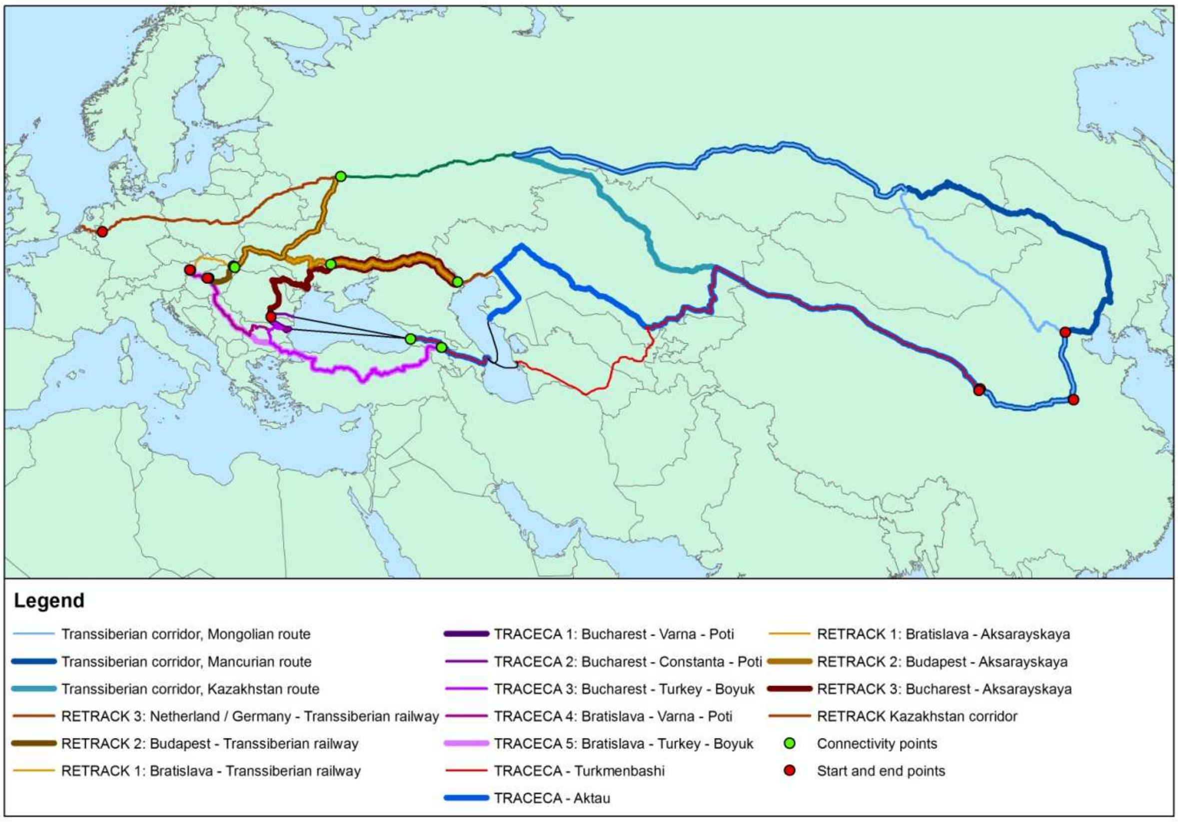
With the EU membership of new member countries in South-East Europe and Central Europe new opportunities but also challenges for long distance intermodal transport emerge. The East-West-Corridor from BENELUX via Germany and Poland to the Baltic States and to White Russia / Russia and further on to China will become a major freight corridor within the coming years. The North Sea Baltic Corridor is an important part of the TEN-T corridor network and will receive EU co-funding for infrastructure investments (for TEN-T corridors see [European Commission, 2014]). The most important project within this corridor is "Rail Baltica", a European standard gauge railway between Tallinn, Riga, Kaunas and

North-Eastern Poland. (European Commission, 2014) This standard gauge rail track will open new chances for rail freight in general but also for trailer transport on railcars. When "Rail Baltia" is implemented there will be substantial advantages for intermodal transport in comparison to road transport.

Table 3. Routing options Berlin - Kaunas (Rail Baltica)
Tabela 3. Opcje tras Berlin - Kaunas (Rail Baltica)

| Option | Route | Distance (km) | Time (hrs) | Costs (€) | CO2-Emmission (kg) |
|---|---|---|---|---|---|
| **Road**<br>Truck / Semitrailer | Berlin-Frankfurt(Oder)-Poznan-Plock-Suwalki-Maijampole-Kaunas | 974<br>(all road) | 30 | 995 | 760 |
| **Road/Ferry**<br>Truck / Semitrailer on Ship | Berlin-Sassnitz-Klaipeda-Kaunas | 1,068<br>(318 km road D +535 km ferry +215 km road LT) | 29.5 | 1,137 | 535 |
| **Road/Rail via Rail Baltica**<br>Truck / Semitrailer on Railcar | Berlin - FV Großbeeren-Warschau - Kaunas | 1,021<br>(23 km road, 998 km rail) | 30 | 625 | 337 |

Source: Wagener, 2011




Source: Davydenko, 2012

Map. 1 Rail corridors between Europe and China
Mapa. 1. Korytarze kolejowe pomiędzy Europą i Chinami

Table 4. Comparison of Freight Costs and Lead Times for one 20' - Container (< 16.5 tons)
Tabela 4. Porównanie kosztów przewozu i czasów dla kontenera 20' (< 16.5 ton)

| **Route Duisburg (D) – Lanzhou (PRC)** | Km | **Single Waggon Load** | | **Block Train** | |
|---|---|---|---|---|---|
| | | USD | Days | USD | Days |
| TransSib-Kazakh route | 9,118 | 6,730 | 28 | 3,200 | 18 |
| TransSib-Mogolian route | 12,028 | 6,705 | 38 | 4,700 | 22 |
| TransSib -Manchurian route | 13,055 | 6,705 | 39 | 4,600 | 20 |

Source: Davydenko, 2012

A model calculation shows that road/rail transport of one semitrailer via Rail Baltica would need the same transit time but would save up to 37% of costs and 56% $CO_2$-emmission, compared to pure road transport (price basis 2011).

Concerning the rail freight corridors between Europe and China the RETRACK project of the EU investigated different routes and identified opportunities and bottlenecks. Map 1 illustrates possible routes between the relation of Duisburg (D) and Lanzhou (PRC). Among the TRACECA corridor and the RETRACK (Central) corridor, the TransSib corridor with the routes via the Transsibirian Railway proved to be the most competitive between Germany and China.

On this corridor several technical barriers between different rail systems both in technical but also in operational terms exist. Two different railtrack systems (1,435/1,520 mm) require transhipment or changes of boogies at border crossings between European and Russian as well as between Chinese and Russian systems. Non-electrified, single track rail tracks, several different electrification system (AC and DC), different signalling and train control systems and different maximum train lengths between 600 m (in PL) and 1000 m (in RU) are technical barriers which complicate inter-operation on this intercontinental route. But railway companies work on facilitating traffic on this corridor, e.g. RZD through the project "TransSib in 7 days".

Among the different TransSib routing options the TranSib - Kazakh route is the most competitive one.

In comparison to sea freight the rail transport from China to Europe via TransSib offers a lower transit time at a higher price. The price level (index) from Shanghai/Bejing to Moscow for sea freight to rail freight is as 3 to 5. The lead times (days) terminal to terminal from Shanghai/Bejing to Moscow are sea freight / rail freight as 33-40 days to 10-12 days. Therefore the TransSib route enables to offer a new intermodal product (with triple price for one third of transit time compared to sea freight) which serves a niche market for high value and time sensitive cargo originating or destined from / for Chinese inland places, preferably in the Western and Northern parts of China [Davydenko, 2012]. The operation of through going block trains instead of single waggon traffic is a very precondition for efficient transport on this route. Because an 80% utilization of trains is needed, closed company trains dominate instead of open public trains. Main clients are shippers of electronics (from China to Europe) and of automotive parts (from Europe to China). For example, Schenker Rail has operated more than 200 trains for BMW from Germany to the fabrication plant in Shenyang in China [Albert, 2013].

It will be a challenge for this Europe-China container transport system to establish efficient container logistics which solves imbalances in trade flows and to develop public train concepts. Also technical and commercial interoperability is an objective which requires a harmonized legal framework (COTIF / SMGS) and solutions for technical interoperability, e.g. through multi-systems locomotives. The experiences with the corridor management gained within the EU should be considered if they are appropriate also for Pan-European corridors.

## SUMMARY AND CONCLUSION

To sum up, intermodal transport needs a re-thinking if a more than organic growth is aimed for. Opportunities for further growth base on organizational and technological innovations as well as on new routes with new intermodal products. Concerning organization the establishment of inland distribution centres and hinterland hubs as well as the expansion of carriers' haulage by shipping lines would facilitate rail solutions within intermodal transport. New innovative technologies for rail transport of non-crane able semi-trailers would open this huge market for intermodal transport. Long distance freight corridors, in particular on the North -Sea Baltic and Europe Asia Corridors through Germany and Poland, open new routes for intermodal transport and enable to offer new products with a different price/time-ratio compared to unimodal transport. Further research is needed and should be focused on financial and economic appraisal of different variants of the innovations as well as on the effectiveness of state intervention policies to promote intermodal transport.

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Intermodaler Verkehr in Europa - Chancen durch Innovation

# TRANSPORT INTERMODALNY W EUROPIE - INNOWACYJNE SZANSE JEGO ROZWOJU

**STRESZCZENIE**. **Wstęp:** Wolumen przewozów towarowych liczony w tono-km wzrośnie w krajach OECD do roku 2050 w porównaniu do roku 2010 od 150 do 230%. Pomimo tego, że Unia Europejska dąży do tego, aby 30% transportu drogowego, realizowanego na dystansach dłuższych niż 300 km, przesunąć do roku 2030 do strefy transportu kolejowego i morskiego, najnowsze trendy rozwojowe w tym zakresie wskazują raczej na stabilny rozkład statystyczny udziału transportu drogowego w całym wolumenie przewozów towarowych, kształtujący się na poziomie 75%. Konwencjonalny transport intermodalny w obrębie najważniejszych, europejskich ciągów komunikacyjnych wskazuje w ostatnich latach na jego stały, aczkolwiek ograniczony w swej dynamice wzrost. Z tego też względu istnieje konieczność opracowania nowych, innowacyjnych koncepcji rozwiązań w sferze transportu intermodalnego, skutkującego przeniesieniem możliwie dużego wolumenu towarów z transportu drogowego na transport kolejowy.
**Metody:** W artykule zdefiniowano warianty rozwiązań dla transportu intermodalnego oraz przeanalizowano w oparciu o istniejące statystyczne źródła i bazy danych trendy rozwojowe w zakresie transportu kombinowanego w Niemczech i w Polsce. Na bazie zrealizowanych w ramach najnowszych, istotnych dla istoty badań projektów (RETRACK, SCANDRIA, Rail Baltica) oraz w oparciu o własne rozpoznanie rynku określono innowacyjne koncepcje rozwoju transportu intermodalnego.
**Wyniki:** Przedmiotowa analiza prowadzi do konstatacji, że nowe, innowacyjne koncepcje w zakresie transportu intermodalnego dotyczą zarówno nowych form organizacyjnych, zastosowania nowoczesnych technologii, jak również wytyczenia nowych korytarzy transportowych. Przedstawiono i poddano dyskusji trzy opisane w artykule, innowacyjne rozwiązania dla potrzeb realizacji przełożenia w ramach transportu intermodalnego przepływu towarów z drogi na szyny, które to rozwiązania będą wspierały rozwój przez spedytorów morskich multimodalnego transportu na ciągach komunikacyjnych od portów w głąb kontynentu, ponadto powstawanie innowacyjnych technologii w zakresie przeładunku naczep siodłowych, nieprzystosowanych do przeładunku przy pomocą dźwigów i suwnic, jak również do wytyczania korytarzy transportowych dla realizacji transportów intermodalnych na obszarze sieci TEN -T i korytarza Europa - Azja.

**Wnioski:** Większa dynamika wzrostu w zakresie przekładania punktu ciężkości z transportu drogowego na transport kolejowy za sprawą komunikacji intermodalnej wymaga wdrożenia nowych, innowacyjnych koncepcji, które wyjdą poza przyjęte i stosowane w Europie zachodniej, tradycyjne rozwiązania w zakresie tradycyjnego transportu kombinowanego. W artykule przedstawiono trzy wybrane, innowacyjne koncepcje tego typu rozwiązań. Wskazano na konieczność kontynuacji badań, szczególnie w zakresie nie tylko pogłębionej, jednostkowej oraz ogólnoekonomicznej oceny zaproponowanych rozwiązań, ale również pod względem skuteczności przedsięwzięć, realizowanych przez poszczególne państwa w ramach kształtowania określonej polityki transportowej.

**Słowa kluczowe:** transport intermodalny, transport multimodalny, transport kombinowany, korytarz transportowy, transport kontenerowy, naczepy siodłowe bez możliwości przeładunku przy pomocy urządzeń dźwigowych, innowacje

# INTERMODALER VERKEHR IN EUROPA - CHANCEN DURCH INNOVATION

**ZUSAMMENFASSUNG**. Einleitung: Das Gütertransportaufkommen in Tonnen-km wird in den OECD-Ländern erheblich bis zu 150 bis 230% im Jahr 2050 im Vergleich zu 2010 wachsen Obwohl die EU-Politik darauf abzielt, 30% des Straßengüterverkehrs über 300 km bis 2030 auf andere Verkehrsträger wie Eisenbahn oder Schiff zu verlagern, zeigen die jüngsten Entwicklungen einen eher stabilen Modal Split Anteil des Straßenverkehrs bei ca. 75%. Der konventionelle intermodale Verkehr auf den wichtigsten europäischen Strecken zeigt ein stetiges, aber nur ein begrenztes organisches Wachstum den letzten Jahren. Neue, innovative Konzepte für den intermodalen Verkehr und für die Verlagerung von der Straße auf die Schiene sind daher notwendig.
**Methode:** Die Varianten des intermodalen Verkehrs wurden definiert und die Entwicklung des kombinierten Verkehrs in Europa und in Deutschland und Polen auf der Grundlage der verfügbaren statistischen Datenquellen analysiert. Neue, innovative Konzepte für den intermodalen Verkehr wurden auf Basis Sekundärforschung, der jüngsten relevanten Projekte (RETRACK, SCANDRIA, Rail Baltica) und eigener Marktkenntnis identifiziert.
**Ergebnisse**: Die Analyse führt zu dem Ergebnis, dass neue innovative Konzepte im intermodalen Verkehr sowohl neue Organisationsformen als auch neue Technologien sowie neue Routen betreffen. Die folgenden, drei Innovationen, welche die Verlagerung von der Straße auf die Schiene durch intermodalen Transport begünstigen, werden vorgestellt und diskutiert: multimodale Beförderung durch Reeder in maritimen Hinterlandverkehr, innovative Technologien für den Umschlag nichtkranbarer Sattelauflieger und die Entwicklung von Güterverkehrskorridoren für den intermodalen Verkehr innerhalb des TEN -T-Netzes und im Europa-Asien-Korridor.
**Schlussfolgerungen:** Ein beschleunigtes Wachstum in der Verlagerung von der Straße auf die Schiene durch den intermodalen Verkehr erfordert neue innovative Konzepte, die über den traditionellen kombinierten Verkehr in Westeuropa hinausgehen. Drei ausgewählte, innovative Konzepte werden hierfür vorgestellt. Weitere Forschung ist notwendig und sollte insbesondere die vertiefte einzel- und gesamtwirtschaftliche Bewertung der Konzepte betreffen sowie die Wirksamkeit staatlicher verkehrspolitische Maßnahmen.

**Codewörter:** Intermodaler Transport, Multimodal Transport, Kombinierter Verkehr; Frachtkorridor, Containertransport, Nichtkranbare Sattelauflieger, Innovation.

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