The potential of the low density high value rail freight market in Europe

JACKSON, Ross, Freight Logistics Research Group, NewRail - Centre for Railway Research, University of Newcastle Upon Tyne, NE1 7RU, UK;

ISLAM, Dewan Md Zahurul, Freight Logistics Research Group, NewRail - Centre for Railway Research, University of Newcastle Upon Tyne, NE1 7RU, UK, *Email for correspondence: dewan.islam@newcastle.ac.uk and telephone: +44 1912223972;*

ZUNDER, Thomas Hagen, Freight Logistics Research Group, NewRail - Centre for Railway Research, University of Newcastle Upon Tyne, NE1 7RU, UK;

SCHOEMAKER, Jarl, NEA, Bredewater 26, NL-2715 CA Zoetermeer, P.O. Box 276, NL-2700 AG Zoetermeer, The Netherlands; and

DASBURG, Nathaly, NEA, Bredewater 26, NL-2715 CA Zoetermeer, P.O. Box 276, NL-2700 AG Zoetermeer, The Netherlands.

Abstract

The objective of this paper is to assess the market potential of rail freight transport for low density, high value (LDHV) goods. The research combines top down and bottom up approaches. The top down analysis consists primarily of a transport demand modelling exercise, which assesses the demand for LDHV goods by road as a specific target market for new innovative rail freight concepts. The transport demand assessment presented in this paper is based on the previous research work of ETISplus and iTREN projects. The research finds that 12% of the current EU 27 and Switzerland (CH) road freight market falls within the research definition of LDHV goods transported over distances of 200km or more. Currently, however, this significant market potential is severely constrained by, among others: rail infrastructure capacity; extra handling cost, time and reliability risks at terminals; opening hours; and densely situated terminals and networks. The bottom up approach collects market intelligence through ten interviews with shippers and operators. The study suggests that, despite these constraints, a new rail freight service offering a more competitive service - in terms of reliability, cost, flexibility and transit time - is anticipated to enable a modal shift and match the level of service currently demonstrated by road.

Keywords: transport policy, market research, railways, freight, Europe

Introduction

In the global competitive market, shippers and consignees require a logistics service with the reliable, consistent and precise movement and storage of goods. Regarding customer requirements Mangan et al. (2008 p.9) states that 'logistics involves, getting the correct product, in the correct quantity and quality, at the right place, at the right time, for the right customers, at the right cost'. These service requirements become even more crucial for time-sensitive, lower density and higher value goods (LDHV). These LDHV cargoes are generally transported by non-rail modes of transport, for example road. Road transport is cost effective for shorter distances and air transport is effective when time critical premium products justify a higher transport cost. In many cases, road and air offer multimodal services for such LDHV cargoes, where road serves the pre and post haulage and air transport provides the main trunk haul. In the European context, road transport is favoured inherently for the transport of LDHV goods, as the origins and destinations are in densely populated areas. As a result, the major road networks are now congested and, in many cases, road transport has become unreliable. It is also generally recognised that road transport is less environmentally friendly than transport by rail and/or inland waterways, despite significant improvements in vehicle emissions and other measures.

Traditionally, rail has transported high volume, low value cargo such as coal and ore. In the European context, with the adoption and implementation of numerous EU Directives and Railway Reform Packages since 1991, the rail freight operators (both incumbent and new entrants) are increasingly acting on a commercial basis (CER, 2006; CER 2008). Despite such action at national and European level, the share and volume of rail freight has not increased. In contrast, because of its dynamic and customer oriented service offering, road transport has been growing steadily (EC, 2012). This is reflected in the significant growth in container transport (OECD, 2012) in recent years. This indicates that, if the logistics requirement can be met, there is a market opportunity for rail freight to grow by capturing some of the LDHV cargo typically transported by container. In part, this is due to the increasing congestion on roads, but is also due to the need for the reliable and environmentally friendly transport of goods. At the same time, to meet customer requirements, rail freight has to rise to the challenge of providing a much more reliable, cost effective, accessible and available service, as well as complying with other competitive market demands. Furthermore, in congested national or international traffic situations, rail freight may have a competitive advantage compared to other modes of traffic. However, rail cannot rely on the discomfort of its primary competitor – road - to secure penetration of markets governed by demanding imperatives in terms of precision, reliability, security and cost competitiveness.

Objective:

One of the EC objectives presented in the 2011 White Paper is to shift 30% of current road freight, transported over 300 km, to other modes, such as rail or waterborne transport, by 2030 and more than 50 % by 2050 (EC, 2011). The current research aims to assess the potential to develop a new rail freight concept/service that provides a higher level of service for LDHV goods. The proposed new rail freight service is anticipated to adopt a long term, radical and first principles approach that can compete with road and air, in the growing sectors of logistics where rail freight has had traditionally little to offer. This is novel in that no academic or contract research has explored the opportunities and potential barriers to rail freight development in this sector, neither in Europe, nor elsewhere.

The paper is structured as follows: Introduction, Methodology, Freight Demand Results, Summary and Conclusion.

Methodology

Combined method

To its advantage, this research uses an integrated approach of quantitative, top down analysis of transport demand and bottom up qualitative interview. An integrated approach is typically used in the assessment of a scenario. Scenarios are defined by many authors as a coherent illustration of possible future situations together with pathways that might lead to these situations (Kosov and Gaßner, 2008, p. 9; Grunwald, 2002). The top down approach uses the TRANS-TOOLS model, drawing heavily from the ETISplus database (described below) in order to estimate the current transport flow of LDHV goods. This is calibrated with Eurostat data.

ETISplus (2013) suggests that European transport data users encounter different problems of data interpretation, due to heterogeneous methodologies and approaches associated with the available data sources from different countries and companies, with different contexts and backgrounds. This problem requires multiple efforts - a kind of reinvention of the wheel - in terms of knowledge management, as well as data collection, storage and retrieval. To solve this problem, the concept of a common transport policy database to be used by, among others, policy makers, analysts, researchers, academics, and modellers, was first implemented through the framework project ETIS in 2005. Subsequently, the ongoing ETISplus project is regarded as the European Transport policy Information System, combining data, analytical modelling with maps (GIS) and a single online interface for accessing the data. It aims to provide a bridge between official statistics and applications within the European transport policy theme. This knowledge base provides a one-stop-portal for accessing the database and for finding project and data related documentation. The ETISplus (2013) website notes that: ‘European Transport Policy Makers have an on-going requirement for good quality input data to support models, evaluation methodologies and indicator frameworks. Without information integration, DG-MOVE lacks a consistent data source covering: Passengers and freight, All modes of transport, and Demand and supply.’

With regard to the future demand, forecasts have been made for the medium- (2020) and long-term (2030) flows of LDHV goods, using the Integrated Scenario developed by the EU project iTREN-2030[1].

At the same time, the bottom up approach gathers market intelligence, using ten interviews with the potential users (shippers and operators) of the proposed new rail freight service, and further explores work conducted as part of previous EU funded projects.

[1] For more information on iTREN, see: http://ec.europa.eu/research/fp6/ssp/itren_2030_en.htm

Top down assessment

Considering the scope (Europe) and objective of the current research i.e. to determine the total freight demand for LDHV goods in the European transport domain, the current research considered the use of the TRANS-TOOLS model to be most appropriate. The Transport Research & Innovation Portal (2013) notes that, prior to the development of TRANS-TOOLS, there existed a number of shortcomings, such as: a poor representation of the mix of traffic; an absence of intermodality and freight logistics; differences in the implementation of origin-destination freight data base years; outdated software; and an insufficient link between socio-economic effects and external effects within the network. Beyond this, limitations also included limited feedback between network loads, travel speed and transport volumes, and differing Intellectual Property Rights (IPR) over data, models and implementation.

TRANS-TOOLS was developed as an IPR free transport model, covering both passenger and freight services and, importantly, includes intermodal transport. The model combines advanced modelling techniques in transport generation and assignment, economic activity, trade, logistics, regional development and environmental impacts. The freight model itself is notably ambitious since it models trade, logistics chains and mode-chains (e.g. truck-rail-truck or truck-ship-rail). Since the finalisation of the model in 2004, TRANS-TOOLS has been used extensively in European transport research (Burgess and Nielsen, 2008).

TRANS-TOOLS is often used to forecast distant future scenarios, such as the FREIGHTVISION long term vision and action plan for a sustainable, European long distance freight transport system in 2050 (Hansen and Rich, 2011). It is worth noting that there are still some weaknesses in the model, for example it does not consider congestion across the networks, and freight and passenger modes are modeled independently (Ibánez-rivas, N., 2010). This would not impact the demand modeling for this research and was managed accordingly.

TRANS-TOOLS also has the advantage of being able to build upon previous EU modeling work and select and incorporate the best attributes of previous models. Models such as SCENES provided good suggestions for the treatment of traffic passenger transport and the interaction of local and long distance traffic. The VACLAV transport network was a suitable basis for the development of a suitable transport assignment model. The NEAC model provided information for a good description of freight transport and SLAM for logistics.

D-RAIL (2012 p. 30) suggests that the outputs of TRANS-TOOLS are given on NUTS (Nomenclature of Units for Territorial Statistics) level II for freight transport and encompass the following areas:

- Transport data: (ton-km, vehicle-km etc.)
- Modal split (the distribution of transport demand per modality)
- Load on corridors (aggregated results for multiple regions).

Another output is the origin destination (O/D) matrices containing predicted transport demand from an Origin towards a Destination for a certain NUTS level and for a certain commodity.

Such outputs are most essential for the current research.

Definition of LDHV goods

Previous literature has done little to define LDHV goods. Current research therefore started by formulating a suitable definition using indicators such as volumetric weight (kg/m3), volumetric value (Euro/m3) and considered whether goods are perishable (time sensitive). The data used are based on trade data (Eurostat database[2]), transport statistics collected from Eurostat[3] and studies on freight characteristics (for example BMVBS; 2008). A list of products with volumetric weight range can be seen in Annex 1. It should be noted that these weights and values are not considered definitive figures, as they correspond to specific data sets and are highly dependent on the definitions of the indicators and on changes in the way products are packaged and transported. Annex 1 provides time sensitive LDHV products with three criteria: weight, value and whether or not the item is perishable. The following steps have been taken to define LDHV cargo:

1. Goods with a density including packaging (i.e. gross-weight) below 250 kg/m3 are considered LDHV-goods in this study, except live animals, transport equipment, tractors and explosives.
2. Goods with a density between 250 and 300 kg/m3 and with a value of €0.50 per kg or higher (i.e. trade value, excluding taxes and not the retail value) are considered LDHV goods.
3. Perishable goods with a density above 300 kg/m3 and a value below €0.50/kg) are also considered LDHV-goods in this study. Examples of this category are dairy products, horticulture products, fresh and frozen fruits/vegetables and meat.

Transport demand analysis

The transport demand analysis is conducted applying a top-down approach to estimate the potential demand for LDHV goods in EU-27 and CH. The transport demand analysis focused on road transport. Currently road transports the majority of LDHV goods and it is these flows which form the target of the innovative rail freight concept. The chosen time horizon for the transport demand forecast is 2020 for the medium-term and 2030 for the long-term.

As mentioned previously, current freight flow data is taken from the EU ETISplus (2012) project that provides an origin - destination (O/D) cargo transport matrix, for road and rail, for the year 2005. The ETISplus matrix describes the generation and attraction of physical flows of goods between countries and geo-clusters, given the economical and institutional determinants of the base year (i.e. 2005). To obtain more recent information, the current research has adjusted the data to the levels of year 2009, based on freight flow developments observed between 2005 and 2009 (EUROSTAT statistics). Therefore, the year 2009 serves as the base year used for the current study. The data has been analysed in terms of freight volumes (in tonnes) by transport mode and geographical scope.

[2] http://epp.eurostat.ec.europa.eu/newxtweb/

[3] The data from Eurostat were adjusted to 2009 levels.

The second step is to select the LDHV goods from the freight flow data of 2009. The selection criteria behind this process have been discussed previously. The LDHV goods have been selected from the freight flow data of 2009 based on their density (kg/m3) and their value (Euro/kg). This data was derived from the most recent Intra- and Extra EU trade information and from a study performed for the EC on Longer Heavy Vehicles (JRC, 2009). The selected LDHV goods fall under different subcategories (i.e. NST3 commodity types) of the following main NST/R classes:

- 0: Agricultural products (e.g. fruits and vegetables);
- 1: Foodstuffs (e.g. alcoholic and non-alcoholic beverages, meat/fish, dairy products);
- 5: Metals (e.g. tubes, metal alloys and castings);
- 8: Chemicals (e.g. plastic materials and medicinal and pharmaceutical products);
- 9: Other type of products (e.g. appliances, clothing, machinery, furniture and other manufactured articles).

Based on the transport estimates from the year 2009, forecasts were made for the medium (2020) and long term (2030) using the Integrated Scenario developed by the EU iTREN-2030 Project (2012) that combines four existing assessment tools to develop its scenarios:

- TRANS-TOOLS - an EU sponsored transport modelling tool, for transport networks;
- TREMOVE – a policy assessment model which explores the effects of the transport and environmental policy on the freight and passenger transport sectors across the whole EU covering the period 1995 – 2030;
- POLES – simulates long-term energy scenarios up to 2030 with global coverage;
- ASTRA – (ASsessment of TRAnsport Strategies) forecasting the long-term consequences of EU transport and energy policies for the EU27 + NO and CH up to the year 2050.

Bottom up approach

<u>Market intelligence</u>

The market intelligence focuses on the potential transport demand from a bottom-up approach, where more detailed information on the type of LDHV goods that could be transported by rail, is collected. Also, the logistics requirements are identified from the point of view of the key market players. Using a semi-structured interview protocol, the market intelligence has been derived from interviews with ten potential rail freight transport services (i.e. shippers and transport operators).

Freight Demand Results through top down approach

<u>Road transport demand for LDHV goods in 2009</u>

The results of the TRANS-TOOLS freight demand modelling exercise are described and presented in the following tables and text. In 2009 a total of approximately 15 billion tonnes was transported by road in the EU-27 and CH (see table 1). Around 46% of these goods fall under the main NST/R categories relevant for this study (i.e. NST/R levels 0, 1, 5, 8 and 9).

Table 1 – Road and Rail transport in 2009 by NST/R in 1000 tonnes within EU+CH

	Road transport in 2009 in 1000 tonnes		Rail transport in 2009 in 1000 tonnes	
NST/R1 code/ category	Transported volume	Share In %	Transported volume	Share (in %)
0: Agricultural products	1,401,675	8.9%	102,380	9.5%
1: Foodstuffs	1,774,796	11.3%	36,507	3.4%
2: Solid mineral fuels (Coal)	154,778	1.0%	116,123	10.8%
3: Petroleum products	742,395	4.7%	355,768	33.0%
4: Ores and metal waste	2,493,432	15.8%	124,043	11.5%
5: Metals	507,166	3.2%	61,365	5.7%
6: Crude, manufacturing, building materials	4,203,183	26.6%	140,956	13.1%
7: Fertilizers	164,946	1.0%	10,282	1.0%
8: Chemicals	932,839	5.9%	39,884	3.7%
9: Other type of prod	3,398,617	21.5%	54,165	5.0%
Total	15,773,827	100.0%	1,078,228	100.0%

Source: TRANS-TOOLS modelling output

Figure 1 presents the share of transported LDHV goods per selected main NST/R category. The average share of LDHV goods within the total tonnage of the selected groups is approximately 56%, equivalent to 3.8 billion tonnes annually. Most of the LDHV goods fall under the category ‘other type of products’ which includes container traffic, followed by ‘foodstuffs’. These are generally considered goods closer to the end consumers.

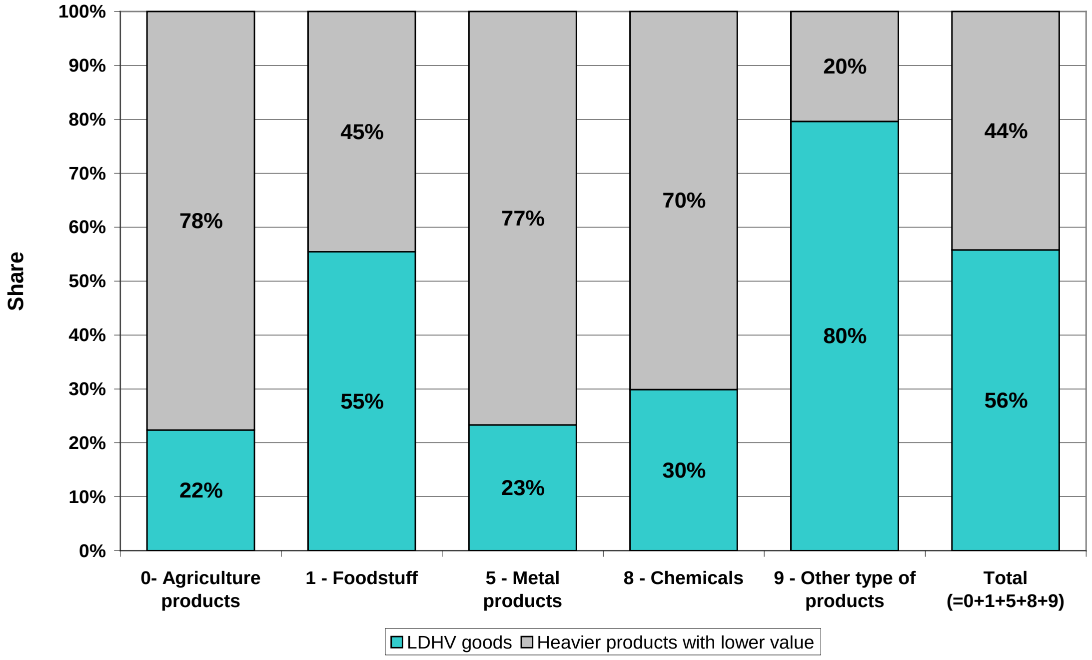

Figure 1 - Share of LDHV goods   Source: TRANS-TOOLS modelling output

The most important countries/regions where the selected goods are being transported by road are given in Table 2. A special pattern of specific industries can be observed in each of these countries. For example, metal products destined for the automotive industry in Italy and agricultural products in France. France is one of the world's leading producers and exporters of agricultural products and the leading agricultural power in the EU, accounting for about one-third of all agricultural land within the EU.

Table 2 - Most important countries/regions for LDHV goods transported by road in 2009

Selected LDHV goods per NST/R category	Most important countries/regions for LDHV goods transport
0: Agricultural products	France, Finland, Sweden, Poland and Spain
1: Foodstuffs	Spain, France, Poland, UK and Germany
5: Metals	(Northern) Italy, Spain and Germany (around the Ruhr area)
8: Chemicals	The Netherlands, Germany, Poland and Italy
9: Other type of products	UK, the Netherlands, France and Italy

Source: TRANS-TOOLS modelling output

Table 3- Share of distance classes (in km) per type of LDHV goods by road in 2009

Selected LDHV goods per NST/R category	<50	50-100	100-150	150-200	200-300	300-400	400-500	>500	Total
0: Agricultural prod.	11%	26%	11%	7%	12%	9%	7%	17%	100%
1: Foodstuffs	15%	22%	9%	7%	12%	10%	8%	18%	100%
5: Metals	16%	21%	9%	7%	12%	10%	7%	20%	100%
8: Chemicals	30%	24%	9%	7%	10%	7%	4%	9%	100%
9: Other type of prod.	15%	21%	8%	7%	12%	10%	8%	20%	100%
Total LDHV goods	15%	21%	9%	7%	12%	10%	8%	19%	100%

Source: TRANS-TOOLS modelling output

Around (10+8+19=) 37% of the total LDHV goods are transported by road over a distance of 300 km or more in the EU-27 and CH (see Table 3).

An intermodal freight transport system that offers door-to-door or origin-to-destination service, generally requires longer distances (e.g. 500km), as it requires multiple transfers of cargo from one mode to another resulting in extra time, cost and increased reliability risks. In some special circumstances, however, intermodal transport can be developed over a shorter distances.

There is no consensus about the cost effective distance for rail freight transport; a modal shift from road is feasible at distances around 200 km (only for terminal to terminal services). This requires pre- and post- haulage on one or both sides, meaning that the total origin-to-destination distance could be more than 200 km. For example, a rail freight transport study (NEA, 2011) compared the costs for rail transportation with road haulage between Coevorden (terminal) and different national and international locations. For the route Coevorden-Rotterdam (terminal) (around 200km), rail transport was found to be financially attractive, with pre- and post haulage distance of 0 to 90 km between the terminal and the clients. In another study (Policy Research Corporation & NEA, 2006) it was concluded that modal shift between dry-dry locations (where origins and destinations are located on the waterside thus requiring no pre- or post- haulage by truck on either side of the transport chain) was only feasible at distances of 200 km or more. Another study (Policy Research Corporation, 2006) found that, if pre- and post haulage can be avoided, inland waterways transport (IWT) can be competitive on shorter distances (with door-to-door transport on distances of even 20 to 40 km onwards).

The share of LDHV goods transported over distances of 200 km or longer is about (12+10+8+19=) 49% (see Table 3). Figure 2 summarizes the transport demand results presented above. It indicates the potential market for LDHV goods, currently being transported by road, over distances of 200 km or greater and that have the potential to be shifted to rail transport. The potential LDHV market in EU-27 and CH was about 12% in 2009. This is almost 1.9 billion tonnes.

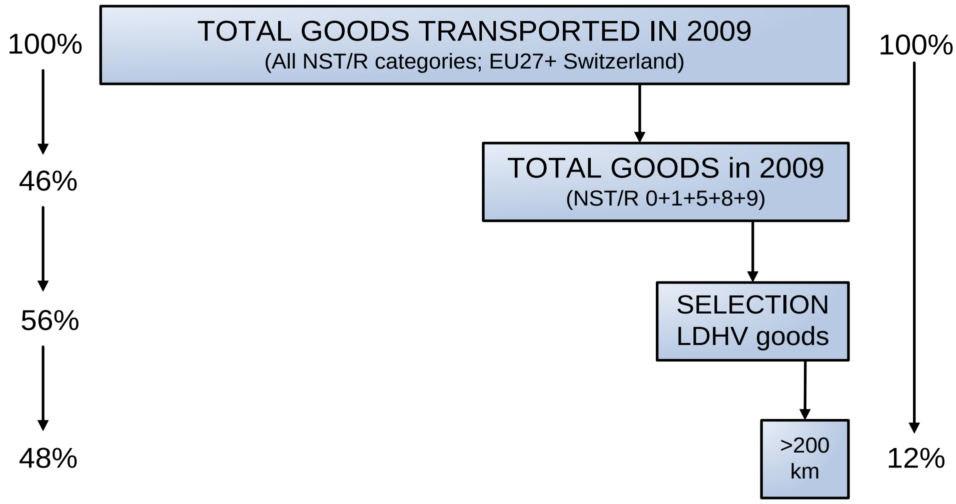

Figure 2 - Identification of LDHV goods transported by road in EU27+CH in 2009

Calculating from the ETISplus Project (2012) data, the current study finds that there are five national and international road transport corridors, over distances of 200 km or longer, that show the greatest demand. On national level these are located within Greece, Spain and Sweden. The most important type of LDHV goods transported is 'other type of products' (NSTR/9). On international transport corridors, these are between Spain and France, Belgium and Luxembourg and The Netherlands and France.

The real potential for a new rail freight concept as a business model will, however, be a smaller proportion of this volume because of (1) the logistics characteristics of the cargo flows - determined by production and supply chain designs, (2) rail freight infrastructure capacity and (3) service level constraints. For rail to really penetrate these markets it will need to adapt its business, operational, commercial and technical model, in terms of infrastructure (terminals, major routes) and rolling stock, to be able to compete effectively within this market which is dominated by road transport. On the other hand, the potential volume is so vast as to be able to present viable and profitable business for logistics companies as a complementary service to road *and/or* traditional long haul rail.

Rail transport demand for LDHV goods in 2009

In 2009 a total of approximately 1.07 billion tonnes was transported by rail in the EU-27 and CH (see Table 1). Currently the LDHV goods on rail are predominantly transported in containers. The greatest volumes are found on corridors such as Italy - Germany, Turkey - Austria or Germany - Ukraine. The exact volume of LDHV goods transported by rail is difficult to estimate, as railway information is relatively scarce, due to confidentiality concerns. In addition, the commodity classification for the NST/R 9 'other type of products' is a mix of container transport, where the commodity transported in the containers is unknown, and genuine 'finished products', such as car transport.

It can be noted that NST/R 2, 3, 4, 6 and 7 together (see Table 3) have a share of 69%. In terms of LDHV, the main NST/R commodities are 0, 1, 5, 8 and 9, which have total share of 31%. The total volume under the NST/R 9 category is almost 54.2 million tonnes. Most of these goods can be considered LDHV goods. However, to a lesser extent, there are also LDHV goods transported under the NST/R (0, 1, 5, and 8) commodities. The overall level of LDHV in rail transport is estimated at 5%, which is approximately 53.9 million tonnes and is found mainly under NST/R 9. For example, the value of the goods on container trains, transporting only high value goods, can amount to €200,000 per container or more. Examples of these are the Samsung trains between Rotterdam and Bratislava with TVs, or John Deere machinery and spare parts between Bremerhaven and Forst (in Germany). All other NST/R categories are assigned as non-LDHV goods.

Road transport demand for LDHV goods in 2020 and 2030

The medium and long-term forecasts of the LDHV goods transported by road are presented in Table 4. The LDHV goods transported by road are expected to grow by 23% by 2020 (an estimated growth of 2% per annum on average) and by 53% by 2030, compared to 2009 (2.5% per year growth, on average). The transport by road of metal products and “other type of products” are expected to show the highest increase.

Although the growth is expected in all countries, the strongest increase is expected in the Eastern-European countries (e.g. Poland, Czech Republic, Hungary, Romania), Spain and also in the area between the UK and France (i.e. London and Northern France). The countries that were important in 2009 in specific market segments will continue to grow and to be among the top 30 locations. However, the growth is not expected to be as strong as in Eastern Europe. For the transport of “other type of products” (NSTR9), besides the forecasted increase in the Eastern European countries, Northern Europe (e. g. Sweden and Latvia) are also expected to show a strong increase. The only market segment where the Eastern European countries (except Poland) are not expected to transport large quantities by road in the medium and long-term is the transport of LDHV chemicals.

Table 4 - Road transport demand for LDHV goods within EU27+CH in 2009, 2020 and 2030

Selected LDHV goods per NST/R category	In million tonnes			Index (2009=100)		
	2009	2020	2030	2009	2020	2030
0: Agricultural products	262	311	374	100.0	118.9	142.9
1: Foodstuffs	882	1,056	1,283	100.0	119.7	145.4
5: Metals	106	133	167	100.0	125.4	157.1
8: Chemicals	201	234	276	100.0	116.6	137.6
9: Other type of products	2,394	2,994	3,784	100.0	125.1	158.0
Total LDHV goods	3,846	4,729	5,884	100.0	123.0	153.0

Rail transport demand for LDHV goods in 2020 and 2030

In 2020 the total volume of rail freight transport in EU-27 and CH is estimated to increase to 1.4 billion tonnes (assuming annual average growth of 2.3%). Relative to 2009, this is a total growth of 29% of total rail freight transport. From 2020 towards 2030, the volume transported by rail is expected to increase to 1.5 billion tonnes (the annual growth rate for this time period is estimated to be 0.7%[4]), which means additional growth of 7%. It is expected that, with the structural changes in the economy and demography, the transport of bulk commodities will decrease. The share of NST/R 9 in total rail transport will increase to a maximum of 7.3% by 2030 (around 3.4% annual growth rate up to 2030).

Table 5 - Rail transport volume within EU27+CH in 2009, 2020 and 2030 (in 1000 tonnes)

	2009	%	2020	%	2030	%
Total	1,078,228	100.0%	1,390,426	100.0%	1,487,756	100.0%
Index Total	100		128.95		137.98	
NST/R 9	54,165	5.0%	75,361	5.4%	108,897	7.3%
Index NST/R 9	100		140.1		200.9	

Defining innovative rail freight service through bottom up approach

Applying the bottom up approach, this section defines the new innovative rail freight service for LDHV cargo. For this, a survey (telephone interviews) was conducted among ten transport and logistics service providers operating in European and worldwide markets.

Interview questions

During October/ November 2011, a total of ten telephone interviews were carried out with potential users of the new rail freight service, such as cargo owners and logistic service providers. After explaining the aims and features of the new innovative rail freight service concept that requires higher speed, increased reliability and flexibility, the ability to integrate with passenger services and the ability to transport temperature-controlled goods, the following questions were asked:

- Would your organisation make use of the new rail freight service if it were in operation?
- For which type of products would your organisation use or not use this rail concept (e.g. due to the time sensitive characteristics of the products)?
- For time critical products, sometimes a premium is paid in order to deliver the goods faster. Which of the identified products fall under this category? And for which is cost competitiveness more important?

[4] Overall, for the time period 2009-2030, the annual growth rate is estimated at 1.5%.

- How much could be transported (e.g. in tonnes, TEU, pallets and/or share of the total volume normally transported)?
- What are the current barriers to using rail transport for these goods?
- What product and service attributes/requirements would you need from the proposed rail freight service to convince you of the capabilities of rail?

Interviewees profile

The interviewees (see Table 6) represented a broad variety of LDHV shippers/producers and transport / logistics service providers.

Interview results

Type of products

Through these interviews, the following types of products for such a rail freight service have been identified:

- General cargo;
- Palletised cargo;
- Swap bodies carrying general cargo (e.g. parcels/boxes);
- Groupage of general cargo currently transported in semi-trailers;
- Food products, such as confectionery and drinks;
- Horticulture products (e.g. flowers);
- Fresh, cooled and deep frozen products needing to be conditioned at 5 degrees Celsius and at 20 degrees Celsius;
- Medical pharmaceutical products needing temperature controlled equipment;
- Spare parts (e.g. for heating technology).

One of the interviewees mentioned that the use of the proposed rail freight concept is not dependant on the type of products, but rather on the location of the service (e.g. near to the consolidation centres and shopping centres).

Reasons to use the proposed rail freight service

Almost all of the interviewees suggested that if the proposed rail freight service became available within 5-10 years, they would consider using the service for the following reasons:

- The need for reliable transport modes;
- The need for fast transport;
- The need for cost competitive transport modes: most interviewees are interested if the rail service were at least the same price level as road transport and had similar and/or faster transit times, but were reliable and environmentally friendly;
- The possibility to use swap bodies (with grappler arm lifting devices for cargo handling) on trains;
- For the transport of large volumes of cargo per consignee;
- For terminal-terminal services;

- The rail concept could compete with airfreight transport

Table 6 Interviewee profile

Interviewee Mgnt level	Country Base	Operating countries	Activities
Middle	Germany	Europe wide	VTL - a groupage network/co-operation of freight forwarding companies
Top	Germany	Europe wide	BLT - a logistics service provider/freight forwarding company,
Top	Germany	42 European states	GLS - a parcel and express service provider active in 42 European states
Middle	Germany	Worldwide	B.Braun - a shipper/producer of a range of high value medical products
Middle	Germany	Worldwide	Viessmann – a shipper/producer of heating systems
Middle	Netherlands	West Europe	MS Mode International - a company in the fashion retail sector with approximately 400 stores throughout (Western) Europe
Middle	Netherlands	Worldwide	Royal FrieslandCampina - a multinational dairy company, whose products are sold in over 100 countries,
Middle	Netherlands	Netherlands	Lekkerland – a supplier of food and non-food products to various stores located in urban areas all over the Netherlands (varying from the city centres of large cities to petrol stations)
Operational	Netherlands	Europe wide	Shuttlewise - a Dutch intermodal operator, which owns an operational branch in Italy, currently manages few clients carrying temperature-controlled goods. Shuttlewise organises shuttle intermodal trains along the Benelux-Germany-Italy corridor.
Top	Netherlands	Worldwide	Wim Bosman - a logistic service provider in the Netherlands that operates world wide as part of the Main freight team. Within Europe, Wim Bosman performs amongst others: national distribution, international groupage transport, European express distribution, etc.

Only one interviewee indicated no interest in the rail freight service. This was due to their volume being too small. This demonstrates the importance of the involvement of a freight forwarder (3PL or 4PL) that will aggregate small consignments and consolidate in a nearby consolidation centre (CC) or railway. At the destination terminal, the unloading and delivery of the small consignments will be performed by the freight forwarder to the final destinations. Small consignments represent a large share of the total freight volume, but current rail freight services are unable to provide a suitable service offering to capture these cargo flows.

Time versus cost competitiveness

Several interviewees indicated that, for goods requiring a maximum transit time of 24 hours, a premium is normally charged. For deliveries longer than 24 hours, normally no surcharges are paid. For most of the type of goods identified, cost is more important than transit time. In this case, if the transport costs by train are higher than by truck, the interviewees see little point in transporting by rail. If road congestion continues to increase as anticipated, rail will become increasingly attractive for the transportation of these types of products. However, rail should not simply rely upon the discomfiture of its primary competition and expect traffic to automatically transfer to rail. Another alternative approach could be to offer a lower total logistics cost. If the total logistics cost approach can deliver a lower warehousing and inventory, higher rail transport cost can be traded off against this and be acceptable to customers.

Potential volume

The interviewees indicated that the potential volume for the rail freight concept is difficult to estimate, especially because the service has not yet been developed. The potential volume will mainly depend on the comparative costs and service level (including door-to-door service, transit time and reliability) between rail and road. The volumes may vary from 200 kilograms per day (for late shipments) to 1,500 swap bodies per day for terminal-terminal services. One of the interviewees mentioned that if the CC's and shops were relatively close to a railway terminal, and the service requirements were met, then they would consider transporting all of their products by rail.

Barriers in the rail sector for the transport of LDHV goods

The following barriers to using such a rail freight service are observed by the interviewees:

Additional handling costs and time: intermodal rail transport is considered by some to be cost and time consuming; using trucks for the pre- and post haulage requires additional handling and thus attracts additional costs. Also, if a terminal is relatively far from the origin or destination, a 24 hour door-to-door transit time will be difficult to achieve, allowing only for 48 hour transit times. This suggests a degree of inflexibility to work around terminal times and preferred delivery slots at shippers/customers preferences. These items will need to be examined to identify whether rail based solutions could work in this context. Also, trucks may lose time in traffic jams, but using intermodal solutions may incur handling time penalties, though these can be minimised.

The density of the rail terminal network: often the distance between the nearest rail terminal and the point of delivery is too great. In these cases, the potential time advantage in transit is lost due to the loading and unloading of goods on to trucks, combined with the long pre- and post haulage distance.

The rail sector is considered by some to be inflexible and/or unreliable (e.g. labour disputes). For time-critical products, on shorter distances, railway is not considered as an alternative to road transport. In the event of congestion, a truck has the flexibility to deviate from its original path and schedule. With railway transport, this flexibility can be lost using current operational and technical models. Road transport is estimated to deliver 95% of the goods within the time frame agreed by the shipper/receiver.

The opening and closing times of many intermodal terminals does not fit with the needs of the clients. The move to 24/7 operation may become mandatory.

The unwillingness of some intermodal transport operators to adapt to the transport schedule for smaller shipments is a barrier. This is a commercial risk that could be influenced by responses and requests from the shippers.

Ordering and providing wagons is considered to be complicated and time consuming. It could and should be a lot easier. Models from North America might be usefully investigated to identify how this process could be made much more efficient. The use of fixed formation wagon-sets might also be considered.

Funding for investment in infrastructure and rolling stock is a barrier, as there is the need to invest in new wagons and to make improvements in infrastructure. At present, little funding is available.

Proposed rail freight service attributes/requirements

The reliability of the proposed rail freight service must be kept at least at the same level as road. This should not be a goal, but a requirement. If we take deliveries of consumer goods to city centre shops, within time-windows, as an example, the goods need to be delivered on time with a maximum of two hours deviation. If the goods arrive late, the delivery must take place on the next day (i.e. higher costs and time loss). This might be offset by moves to spread logistics delivery windows ahead of the morning and after the evening peak commuter flows, including appropriately safeguarded, night-time deliveries.

The proposed rail freight service must be cost competitive with road transport (including the additional handling costs and door-to-door delivery). Some of the interviewees mentioned that they would consider a slower (e.g. 1 day longer) door-to-door service for non-time sensitive products, only if the costs advantages would be significant. For time critical products, faster and reliable transport is more important than the costs.

The rail service should have competitive transport times compared to road; for some products a <24-hour transit time service is needed.

The rail service should be agile and flexible (be available on demand 24/7).

The rail service should have frequent departures to reduce the time spent at the hubs. This argues against the case for large trains with extensive loading and discharge times and supports shippers/receivers requirements for frequent replenishment.

The rail terminals, or loading points, should be near to the CC's and the customers of the companies, to avoid time and costs consuming pre- and end-haulage.

Ability to transport different types of temperature controlled products at the same time (e.g. fresh and frozen goods, requiring different temperatures).

The rail freight service needs to apply an integrated door-to-door service concept, using CC and 3PL/4PL to deliver goods to the customers. This will incorporate the service with a last-mile solution (conventional railway transport cannot usually perform the last mile distribution to a store).

Extend the opening and closing times of the rail terminals. A 24/7 service should be achieved.

Safe and secure transport with high quality standards is required, especially for the transport of foodstuffs, spare parts and pharmaceutical products. Condition monitoring and security both need to be in place throughout the whole transit.

The use of alternative (shorter) train configurations might be a more cost effective means.

The rail infrastructure and the rolling stock (e.g. wagons) need to be considerably improved (e.g. to achieve higher axle load).

The tracking and tracing of cargo is vital for the customers. Also, a higher level of control and planning of train operations is required**,** to drive up train productivity. The rail operation needs to develop the capability to respond rapidly to spot or short-term traffic offers, or it risks losing traffic governed by such conditions, to road as the default option. The ability to bid for, fix, trade and swap train paths is an area that needs to be developed, to support rail's aspirations in volatile markets.

Summary

A combination of top down and bottom up approaches has been applied to assess the potential of a new rail freight service for LDHV cargo. The top down approach is applied to determine the transport demand, using a modelling approach primarily based on the TRANS-TOOLS model and combining the ETISplus and iTREN project outcomes. Applying a bottom up approach, the new innovative rail freight service for LDHV cargo is defined. For this, a series of telephone interviews were conducted among ten potential users, operating in European and worldwide markets.

Findings from the top down approach - transport demand

The potential LDHV market is estimated to be 1.9 billion tonnes, or 12 % of the total tonnage currently transported by road in the EU-27 and Switzerland (CH), over distances of 200km. There were five national and international road transport corridors over distances of 200 km or longer that showed the greatest demand. On a national level these were located within Greece, Spain and Sweden. The most important type of LDHV goods transported are "other type of products" suitable for containerised transport by rail. International transport corridors between Spain and France, Belgium and Luxembourg and The Netherlands and France were identified as most important. The LDHV goods transported by road are expected to grow from 2009 by 23% by 2020 and 53% by 2030. By 2030 the strongest increase is expected in the Eastern-European countries (e.g. Poland, Czech Republic, Hungary and Romania), Spain and between the UK and France. The findings of two study and demonstration projects: RETRACK (2012) and CREAM (2012), implemented in the European rail freight context, suggest that the shift from road to rail will not occur unless the shippers are offered a genuinely competitive alternative to road transport.

Findings from the bottom up approach – requirements for new rail freight service

The findings of the bottom up approach suggest that the following types of products can be transported by the new rail freight service: general cargo; palletised cargo; swap bodies carrying general cargo (e.g. parcels/boxes); groupage of general cargo currently transported in semi-trailers; food products, such as confectionery and drinks; horticulture products (e.g. flowers); fresh, cooled and deep frozen products needing to be conditioned at 5 degrees Celsius and at 20 degrees Celsius; medical pharmaceutical products needing temperature controlled equipment; and spare parts (e.g. for heating technology).

The findings of the bottom up approach also suggest that if the proposed rail freight service became available within five to ten years, they (interviewees) would consider using the service for the following reasons: reliable transport modes; faster transport; cost competitive transport modes: at least at the same price level as road transport with similar and/or faster transit times; reliability; environmentally friendliness; the possibility to use swap bodies (with grappler arm lifting devices for cargo handling) on trains; for the transport of large volumes of cargo per consignee; for terminal-terminal services; and that the rail concept could compete with airfreight transport.

The study found that there are some notable barriers to developing the innovative rail freight service for LDHV cargo, including additional handling cost, time and unreliability at terminals, operating hours and density of rail terminals and networks. Overcoming these barriers, the new rail freight service attributes will have to include, among others: reliability; competitive cost and transit time; frequent, integrated door-to-door service (not just terminal to terminal), and a tracking & tracing system.

Conclusion

The research shows that there is an appreciable niche of road transport that is both significant and growing at a rate higher than the wider GDP and transport growth trends. This represents a market untapped by rail freight since the middle of the 20^{th} century and represents a new opportunity for modal shift and commerce.

Based on the previously detailed analyses, the innovative rail freight concept is looking towards solutions consisting of fast, reliable and flexible trains, working for high-frequency services, or as multi-stop trains on longer routes. To extend the customer base, some previous studies, such as Islam et al. (2010); Zunder et al. (2012), suggested a hub-and-spoke service concept (where terminal is hub and feeder service is spoke), single wagon loads, or a group of single wagon loads that are consolidated in a hub for a shuttle train. Similar to the hub-and-spoke concept, the CREAM study (2012) applied the ‘string of pearls’ concept, where the ‘strings’ link with the ‘pearls’ (gateways or hub terminals) to achieve an efficient and effective rail operation for intermodal services on the whole, or a part of, the corridor. The service has to go beyond these terminal to terminal concepts to offer door-to-door service, possibly in partnership or alliance with the trucking industry. Also the service may establish links with urban consolidation centres, as the majority of cargoes have origins or destinations at European cities. These options may also operate in combination, as a wholly new model of rail freight operation able to compete with road transport, in terms of service and product competitiveness. These models are not competing with existing rail operations where these are adequate. They extend the commercial and operational "reach" of rail.

The authors believe these concepts will provide the rail freight sector with solutions that can significantly contribute to enhancing its competitiveness. Previous assessments of the external effects (quantified impacts of, for instance, emissions and congestion) indicate that substantial economic benefits can be achieved through the increased use of rail, whilst reducing the environmental and social impacts associated with road transport.

It is noticeable that the conclusions of the quantitative results and the market intelligence differ, in that whilst there is demand, there is a considerable doubt expressed as to whether the industry can supply the services needed. This is a topic worthy of further research.

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Annex 1: List of selected LDHV and time sensitive goods

	NSTR 3 (description)	Average density (kg/M3)	Average value (€/kg)	Perishable goods
Perishables	Butter, cheese, other dairy produce	436	€ 2.40	√
	Milk and cream, fresh	436	€ 0.49	√
	Fruit, frozen, dried, dehydrated; prepared and preserved fruit	401	€ 1.08	√
	Coffee	385	€ 2.61	√
	Meat: fresh, chilled or frozen	385	€ 2.48	√
	Meat: dried, salted, smoked; prepared or preserved	379	€ 2.93	√
	Food preparations n.e.s.	375	€ 1.62	√
	Margarine, lard and edible fats	342	€ 0.88	√
Density >230 and <300 kg/m3 & value ≥ €0.50	Other alcoholic beverages	289	€ 3.80	
	Finished and semi-finished products of non-ferrous metals (except manufactures)	282	€ 3.70	
	Copper and copper alloys (unwrought)	282	€ 5.53	
	Zinc and zinc alloys (unwrought)	282	€ 1.68	
	Lead and lead alloys (unwrought)	282	€ 1.79	
	Aluminium and aluminium alloys (unwrought)	282	€ 1.75	
	Printed matter	282	€ 3.25	
	Cocoa and chocolate	282	€ 2.99	
	Prepared and preserved vegetables	280	€ 0.93	√
	Other non-ferrous metals and alloys thereof (unwrought)	280	€ 20.97	
	Wood and cork manufactures, excluding furniture	271	€ 0.56	
	Tubes, pipes and fittings	258	€ 1.41	
	Other fruit and nuts, fresh	258	€ 1.04	√
	Fish, crustaceans and molluscs, (fresh, frozen, dried, salted or smoked)	257	€ 3.42	√
	Other manufactured goods not classified according to kind	257	€ 2.76	
	Paper and paperboard, unworked	256	€ 0.67	
	Crustaceans and molluscs, fish, prepared or preserved	256	€ 3.69	√
	Dried vegetables	256	€ 0.58	
	Hops	256	€ 3.63	
	Citrus fruit	256	€ 0.73	√

	Other vegetables, frozen	256	€ 1.01	√
	Paper and paperboard manufactures	256	€ 1.42	
	Medicinal and pharmaceutical products; Perfumery and cleansing preparations	252	€ 14.41	
	Plastic materials, unworked	245	€ 1.65	
	Tea, mat, spices	231	€ 2.93	
	Iron and steel castings and forgings	231	€ 2.55	
	Unmanufactured tobacco and tobacco refuse	231	€ 3.63	
Density ≤230 kg/m3	Non-electrical machinery, apparatus and appliances, engines, parts thereof	223	€ 10.78	
	Textile yarn, fabrics, made-up articles and related products	214	€ 4.23	
	Other cereal preparations	212	€ 1.66	
	Eggs	205	€ 1.42	√
	Leather, manufactures of leather and raw hide and skins	205	€ 8.17	
	Man-made fibres	190	€ 1.72	
	Manufactured tobacco	180	€ 16.90	
	Beer made from malt	180	€ 0.64	
	Non-alcoholic beverages	180	€ 0.15	
	Wine of fresh grapes, grape must	180	€ 2.00	
	Electrical machinery, apparatus and appliances, engines, parts thereof	178	€ 15.94	
	Glassware, pottery and other manufactures of minerals	175	€ 1.94	
	Semi-finished products and manufactured articles of rubber	171	€ 4.01	
	Other non-edible raw vegetable and animal materials n.e.s.	161	€ 2.15	√
	Finished structural parts and structures	151	€ 2.11	
	Other manufactured articles n.e.s.	131	€ 9.61	
	Travel goods, clothing, knitted and crocheted goods, footwear	109	€ 14.98	
	Furniture, new	103	€ 3.10	
Density: Including packaging Value: trade value, excluding taxes				

Source: compiled from the EUROSTAT Intra- and Extra- EU trade data and the ETISplus Project study