Report on target markets and KPIs related to ViWaS project developments

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Involved partners

Following project partners have been involved in the elaboration of this document, e.g. by providing existing material, answering questionnaires (done by those project partners involved in SWL operations, namely Bentheimer Eisenbahn, Fret SNCF and SBB Cargo). Eureka contributed voluntarily without being member of the initially agreed team of work package 4 "Strategies and success criteria for SWL specific developments":

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AT	Austria
BE	Bentheimer Eisenbahn
BG	Bulgaria
BLS	Swiss railway company (BLS Cargo AG)
Btkm	Gross tonne kilometres (Bruttotonnenkilometer)
BVWP	German Federal Transportation Master Plan (Bundesverkehrswegeplanung)
CH	Switzerland
CREAM	Customer-driven Rail-freight services on a European mega-corridor based on Advanced business and operating Models – EU project in the framework of FP 6
CZ	Czech Republic
DBSR	German railway company (DB Schenker Rail)
DE	Germany
DESTATIS	German Federal Statistical Office (Deutsches Statistisches Bundesamt)
ECM	Entity in charge of maintenance
EDI	Electronic Data Interchange
ERTMS	European Rail Traffic Management System
ES	Spain
Fig.	Figure
FR	France
FTL	Full train load
GB	Great Britain
GR	Greece
HU	Hungary
ICT	Information and Communication Technologies
IT	Italy
JIS	Just-in-sequence
JIT	Just-in-time
LSP	Logistics Service Provider
Mio.	Million
MLMC	Multi-Lots Multi-Clients
NO	Norway

NSTR	Standard Goods Classification for Transport Statistics, Revised (Nomenclature uniforme des marchandises pour les Statistiques de Transport, Revisée)
OFP	Regional railway undertaking (Operateurs Ferroviaire de Proximité)
PL	Poland
RLC	Rail Logistics Centre
RO	Romania
RSO	Rail Service Online
RU	Railway Undertaking
SBB	Swiss railway company (Schweizerische Bundesbahnen AG)
SE	Sweden
SI	Slovenia
SME	Small and medium sized enterprise
SNCF	National society of French railways (Société Nationale des Chemins de fer Français)
SWL	Single wagonload transport
t	Tonne
TEN-T	Trans-European Transport Networks
tkm	Tonne-kilometres
TR	Turkey
VDV	Association of German Transport Companies (Verband deutscher Verkehrsunternehmen)
VFLI	Subsidiary of Fret SNCF (Voies Ferrées Locales et Industrielles)
Wh	Watt hours
WP	Work package
Xrail	Alliance of seven European freight railways (CFL Cargo, ČD Cargo, DB Schenker Rail, Green Cargo, Rail Cargo Austria, SBB Cargo and SNCB Logistics)

Glossary

JIS	When goods are delivered “just-in-sequence” (JIS), the supplier brings them to the recipient at a particular time and in a pre-determined sequence. This type of supply system is used particularly in the automotive industry.
JIT	"Just-in-time" is a transport service in which the delivery of goods is carried out at a particular point in time. The customer determines when and to which location the goods are to be delivered. JIT is frequently used in production logistics in order to implement production synchronized procurement. With this system, it is possible to avoid using intermediate storage facilities and, as a result, to lower costs.
OFP	OFP stands for “Opérateur Ferroviaire de Proximité”, the French approach for the English term "short line" operator. It is a concept, particularly attributed to the wagon-based rail freight activities. In practice, an OFP is a SME railway undertaking that is providing local freight traffic services, specifically in port areas or regions with lower freight volumes ("capillary freight"). The idea of OFPs appeared in France in the early 2000 during adaptations in the French law in correspondence to the European directives concerning" the opening of the European transport market to competition".
VFLI	Founded in 1998, VFLI is a company within the SNCF Geodis Group specialised in rail transport operations. VFLI is mainly performing services on industrial sites, including logistics operations. The company also offers a range of long-distance rail transport on the national rail network.

1 Introduction

This deliverable "Report on target markets and KPIs related to ViWaS project developments" summarises the main results of WP 4 on finding strategies and success criteria for SWL specific developments of ViWaS. In order to fulfil this goal, the following work steps have been carried out:

- Analysis of the overall development rail of freight transport in Europe and in the ViWaS partner countries, in particular describing the situation of SWL concerning production systems, market shares, main commodities and current challenges and improvement activities. The findings are based on the analysis of available statistical data, studies and desktop research.
- Deduction of main development goals and related key performance indicators (KPIs) for SWL transport.
- Analysis of costs and cost structures in SWL transport in comparison with competing modes based on available studies and information of ViWaS partners.
- Description the current SWL business of the ViWaS partners (focussed on railway undertakings) in particular current and future SWL markets, challenges and strategies for the improvement of their SWL services.

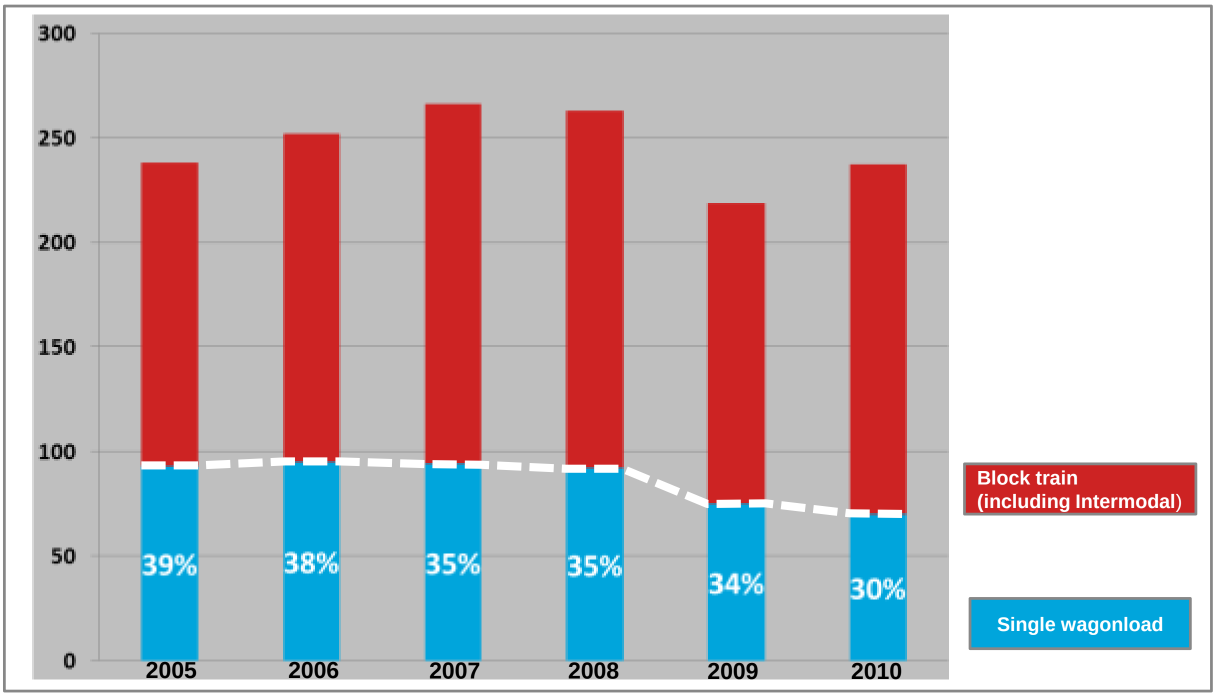
2 The role of SWL transport (country analysis)

2.1 Europe

Single wagonload (SWL) transport is still a major component in numerous European states' transport systems and in the logistics of different economic sectors such as steel, chemical industry and automotive. The development in further large Western European countries in the recent years such as Italy and France and in most of the new EU member states and accession candidate states of Central and Eastern Europe show a downward trend of SWL services. There, SWL is facing serious economic problems on the one side and is suffering heavy market losses on the other.

Currently, some single wagonload transports has an overall market share of some 30% on the total rail freight transport volume in Europe. Figure 1 shows the development of SWL based on transport performance in billion tonne-kilometres for the time period from 2005 to 2010 for selected European countries (namely: Germany, Switzerland France, Italy, Sweden, Poland and Slovenia).

Figure 1: Evolution of rail freight transport in Europe 2005-2010 [based on the transport performance in billion tonne-kilometres]



Source: Oliver Wyman, 2011, based on EUROSTAT data for selected European countries (Germany, Switzerland, France, Italy, Sweden, Poland and Slovenia)

In 2005, rail freight transport had a magnitude of almost 240 billion tonnes-kilometres on which SWL had a market share of 39%. In the following years up to 2010, the share of SWL constantly decreased by an average of 2% per year. In 2010, the market share of single wagonload reached a level of 30%. The total transport performance of SWL decreased from 93 billion tonne-kilometres in 2005 to 70 billion tonne-kilometres in 2010.

The main reasons for the above described developments in SWL business are:

- heavy fixed costs linked to infrastructure and operation of marshalling yards;
- insufficient SWL service profitability due to slow and expensive "last mile" operations and poor utilisation rates of resources, e.g. trains and wagons;
- additional costs to be borne by the shippers to ensure wagon handling in their private sidings;
- insufficient SWL service quality and transport time compared to other transport modes and especially in competition with road (increasingly important in state-of-the-art logistics);
- negligible competition in the SWL segment because of heavy fixed costs, complex operations and the need for a minimum critical mass of traffic;
- loss of profitable markets/transports from SWL rail operators to intramodal competitors and production systems (wagonload block trains/intermodal services) and
- increasingly limited possibilities to cross subsidise SWL from the profitable full train load (FTL) business.

Based on these trends, SWL has developed from a universal, area-wide transport system to a highly specialised logistics product. In this role, SWL will remain a major component in numerous European states transport systems such as in Sweden, Germany, Austria and Switzerland, especially in economic sectors such as steel, chemical industry and automotive. One of the major European initiatives to stop the downward trend of SWL transport is Xrail.

Xrail[1]

Initiated by the UIC in 2007, Xrail is the production alliance of seven European freight railway undertakings (CFL Cargo, ČD Cargo, DB Schenker Rail, Green Cargo, Rail Cargo Austria, SBB Cargo and SNCB Logistics), currently covering 11 European countries.

Xrail aims at raising efficiency and transport quality and thereby increasing the competitiveness of international SWL transport. The alliance does not tackle commercial aspects and has no assets to operate trains on its own. Instead Xrail focuses on production topics of alliance partners in the wagonload segment. In detail the following main goals are set:

- Increase transport reliability through the definition of quality standards and the provision of international transport schedules (goal: minimum 90 % reliability rate for the given ETA),
- Provide customers with transport information (e.g. international transport schedules, delay alerts in combination with updated ETA information, transport status, wagon monitoring and KPI reports)

[1] Source: ViWaS workshop Bologna, 9/4/2013; presentation of Mr. G. Ferk, CEO Xrail

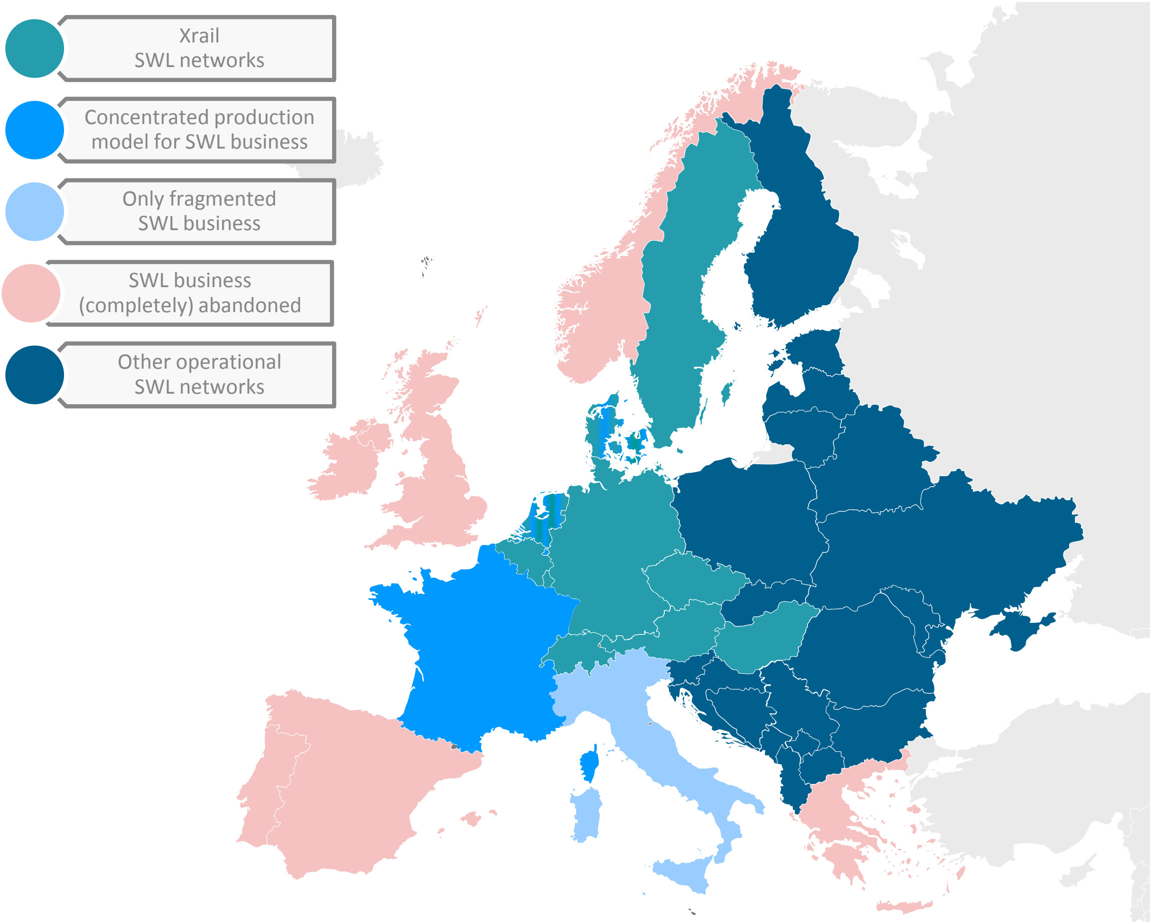
- Guarantee accelerated time to market (= faster preparation of transport quotes).

Xrail has developed new cross-border production standards, supporting IT tools and different quality improvement measures for international wagonload traffic, and all alliance partners are committed to maintaining the high standards of quality and service for the customers.

European SWL networks

A picture on the current situation of SWL business in the European countries is shown in Figure 2.

Figure 2: SWL networks in Europe – overview



Source: HaCon, 2013

In order to generate a more detailed picture of the respective national developments, an in-depth analysis has been carried out for Germany, Switzerland and Italy predominately based on EUROSTAT statistics and current market developments for SWL.

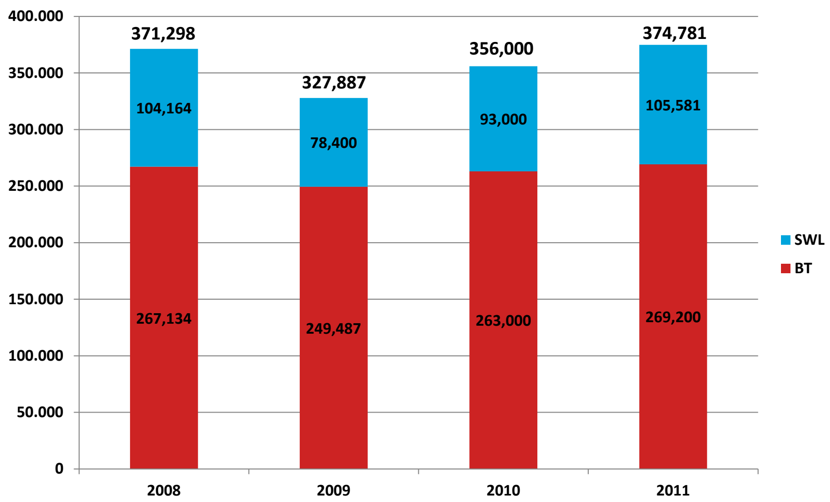
2.2 Germany

2.2.1 Transport volumes and modal split (Germany)

SWL transport in Germany is still dominated by the incumbent operator DB Schenker Rail (DBSR). Although DBSR has adapted the single wagonload production system by the reduction of served sidings (from 6,300 sidings in the year 2000 to 4,800 sidings in 2008) and the liberalisation of the German rail market, followed by the market entrance of new private railway undertakings, no competition in SWL offers has been established. The main barriers preventing private operators from entering the SWL market are high share of fixed costs for rail production and the risk that capacity is not utilised sufficiently.

The development of transport volumes and transport performance in rail freight transport in Germany based on EUROSTAT-data for the time period 2008 to 2011 is shown in Figure 3 and Figure 4, respectively.

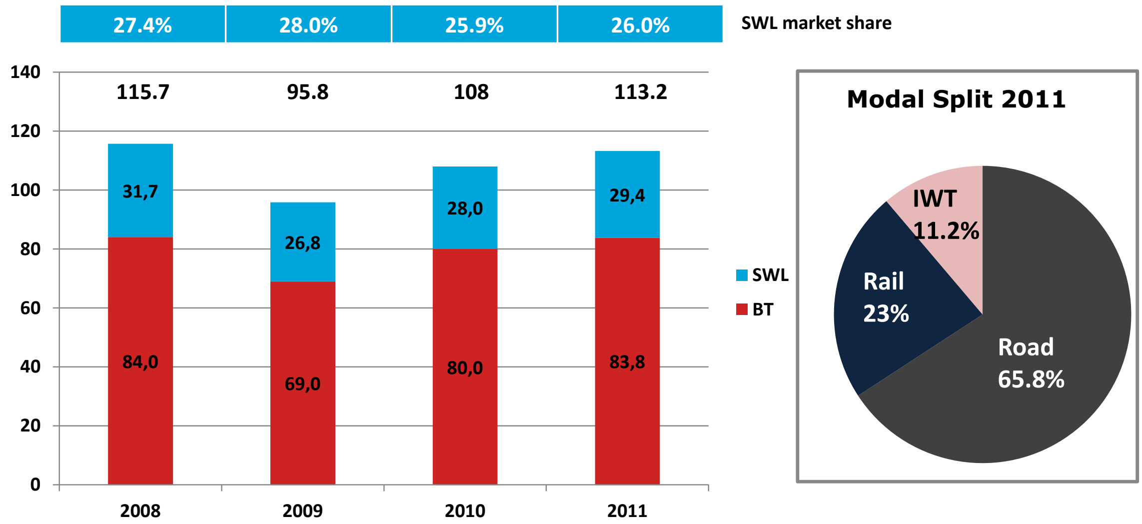
Figure 3: Evolution of rail freight transport volumes in Germany 2008-2011 [in thousand tonnes]



Source: HaCon based on EUROSTAT data

Based on the transport performance in 2011, rail freight had a share on the modal split of 23%. Road transport added up to almost 66% and inland waterway transport (IWT) amounted to 11% (cp. Figure 4, next page).

Figure 4: Evolution of rail freight transport performance in Germany 2008-2011 [in billion tonne-kilometres] and modal split 2011



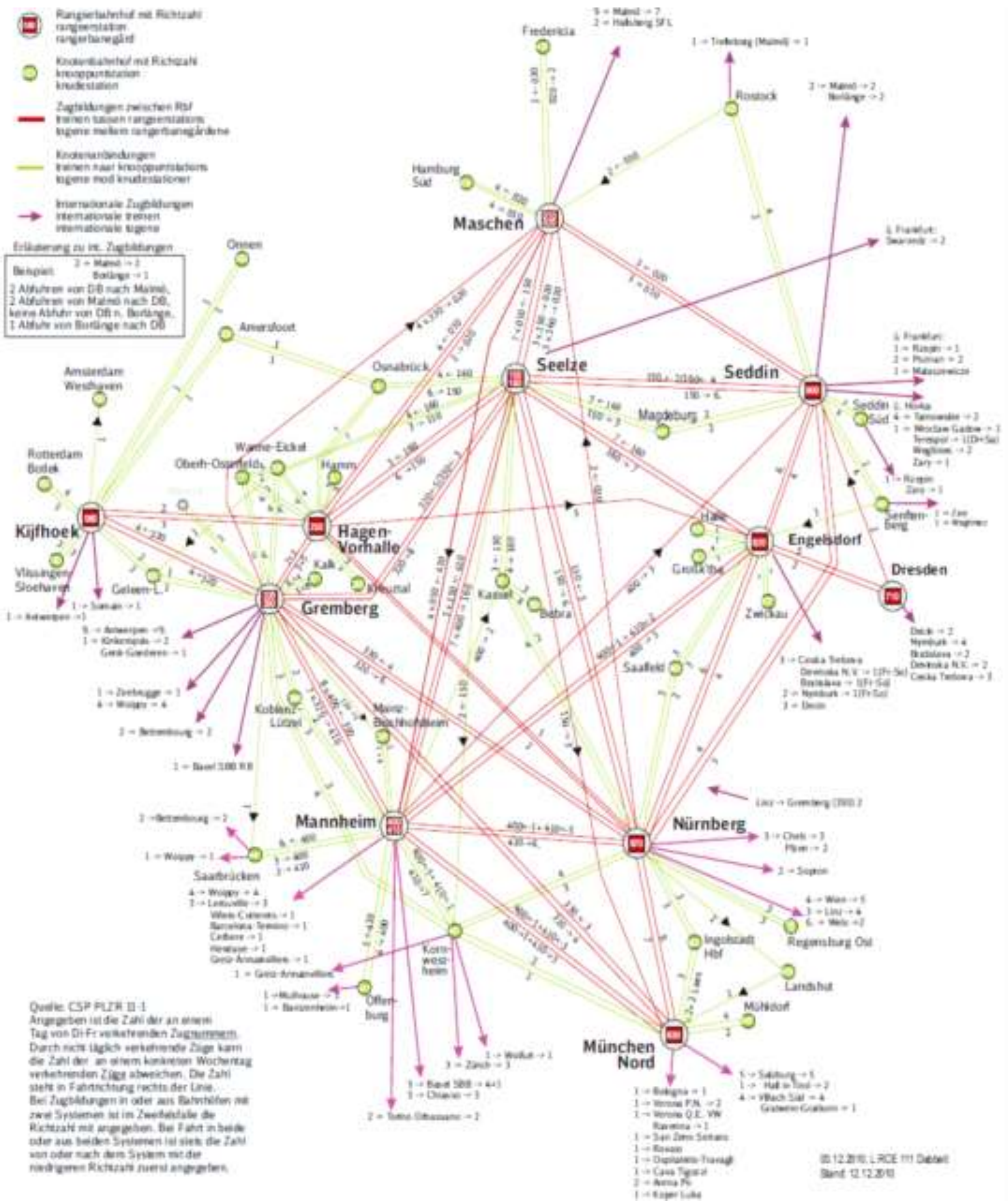
Source: HaCon based on EUROSTAT data

In 2008, the rail freight transport performance had a magnitude of nearly 116 billion tonne-kilometres. Caused by the economic crisis, rail freight performance dropped down by 17% in 2009. In the following year 2010 rail freight volumes increased significantly and reached a value of 113 billion tonne-kilometres in 2011. The market share of single wagonload transport in Germany can be seen as more or less stable in the time period shown in Figure 4: it declines only slightly from 27.4% in 2008 to 26.0 % in 2011. Whereas in 1990 SWL accounted for 52% on the total rail freight transport, it seems that it has been stabilised slightly below 30%. However, it still can be considered as an important component in the overall transport system and for some specific industries (cp. section 2.2.3).

2.2.2 SWL organisation framework (Germany)

The SWL service network in Germany is dominated by the incumbent railway undertaking DB Schenker Rail (DBSR). DBSR still operates a dense network of 10 marshalling yards in Germany (+ one in NL / Kijfhoek) and more than 25 collecting nodes (cp. Figure 5). Smaller railway undertakings, like the ViWaS partner Bentheimer Eisenbahn, are cooperating with DBSR mostly for serving specific regions. Competition from other private operators hardly exists.

Figure 5: SWL production system of DB Schenker Rail



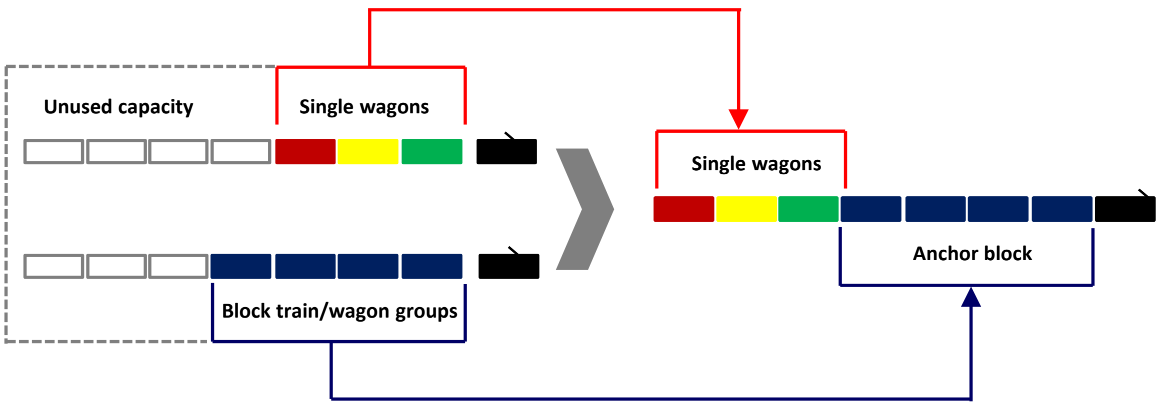
Source: DB Schenker Rail – Dr. Alexander Hedderich Keeping rail competitive – Strengthening single wagon in Hinterland and Europe – 27.10.2011 Hamburg

DBSR has developed and implemented various approaches to improve the efficiency and transport quality in their domestic and international SWL services:

Netzwerkbahn

DB Schenker Rail has developed the business and production concept “Netzwerkbahn” for raising the efficiency of wagonload transport. The general idea behind “Netzwerkbahn” is the linking of block train and single wagonload production networks. The principle of Netzwerkbahn is shown in Figure 6:

Figure 6: Rail production concept Netzwerkbahn



Source: HaCon based on www.dbschenker.com/hoen/news_media/press/news/4023860/rail_netzwerbahn.html

The system is based on trains with “anchor blocks”. They either can be continuous and large consignments from an important customer, but also multiple smaller transport volumes. Once an anchor block is formed, the respective train will be integrated into the schedule and all necessary resources will be planned. Up the day before departure, additional consignments (single wagons or wagon groups) can be added until the maximum train capacity (length or weight) is exploited.

Ideally, the trains will be operated directly between main nodes without being operated via the large shunting yards. It is expected that this saves transport time and lowers production costs. Currently, DB Schenker Rail already moves a growing number of such daily anchor blocks due to the harmonised logistics processes of their customers.

In the conventional SWL production system, shippers hand over their wagons or wagon groups to DBSR without a previous test of available train capacity. The wagons are fed into the SWL production system. A reliable indication of the time of delivery is not possible. Within Netzwerkbahn it is foreseen that customers submit their orders to DB Schenker Rail early - optimally one to two weeks in advance - either by the procedure "Electronic Data Interchange" (EDI) or via the internet portal "Rail Service Online" (RSO).

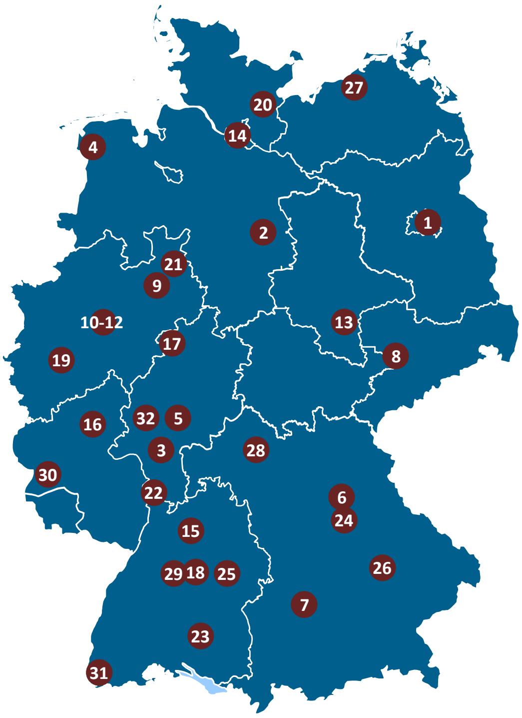
The system requires that the customers are willing and able to book train capacity on a larger scale one to two weeks in advance. For single wagonload customers with a varying number of wagons or unsteady consignments, it is often not possible to exactly predict the transport volumes and book such a period in advance.

First test runs for the new system have been carried out in summer 2013. Netzwerkbahn implementation is planned stepwise from 2014 onwards. On international level, Netzwerkbahn shall be connected with the Xrail capacity booking system that will be implemented in 2015.

Railports

DBSR offers a network of currently more than 30 railports in Germany (cp. Figure 7) and further facilities in different European countries (AT, BG, CH, CZ, ES, FR, GB, GR, HU, IT, NO, PL, RO, SE, TR). Railports are dedicated for the transhipment of smaller consignments between rail and road in order to serve customers which do not have an own siding.

Figure 7: Railports of DB Schenker Rail in Germany



1 Berlin (Ferch-Lienewitz)
2 Braunschweig
3 Darmstadt
4 Emden
5 Frankfurt/M. Osthafen
6 Fürth
7 Gablingen
8 Glauchau
9 Gütersloh
10 Hagen
11 Hagen Gbf
12 Hagen Letmathe
13 Halle
14 Hamburg
15 Heilbronn
16 Koblenz-Lützel Rheinhafen
17 Korbach
18 Kornwestheim
19 Köln
20 Lübeck
21 Löhne-Gohfeld
22 Mannheim
23 Mengen
24 Nürnberg
25 Plochingen
26 Regensburg
27 Rostock
28 Schweinfurt
29 Stuttgart Obertürkheim
30 Trier
31 Weil am Rhein
32 Wiesbaden-Biebrich

Source: HaCon based on DBSR information, status: 2013

Railports usually provide the following facilities

- covered warehouses;
- open storage areas;
- handling equipment for various goods
  e.g. forklifts (handling of pallets or paper) and cranes (for steel and intermodal loading units) at most of the locations. If not permanently positioned, necessary transhipment equipment can be organised on short notice.

The following logistics services are offered in railports:

- bundling of SWL;
- organisation of pre-and end-haulage by road;
- storage and stock management;
- additional value-added logistics services, such as quality management, packaging and order picking;
- realisation of rail-based JIT and JIS concepts.

According to current market analyses and interviews with important SWL customers in Germany, it is expected that this market segment will slightly decline in the next years. However, transport volumes transhipped via railports will have an annual increase of +1.5% until 2016[2].

Membership in the Xrail consortium

Since 2010, DBSR is member of the Xrail alliance (cp. section 2.1). Specifically the DBSR branches in Germany, the Netherlands, Denmark and Northern Italy are involved in the Xrail activities.

The current status and trends of SWL in Germany are summarised in Figure 8.

Figure 8: Status and perspectives of SWL transport in Germany

Germany	Main characteristics / trends
Current status	• SWL share on rail freight: 26% (2011); • Optimised infrastructure network of marshalling yards (10), collecting nodes (>25) and sidings (~ 4,800); • Network of railports (>30) in Germany connected to further railports in Europe.
Main perspectives / improvements	• "Netzwerkbahn" (combining elements from block train and single wagonload transport) – implementation of new production method from 2014 onwards; Introduction of Xrail standards to raise quality and efficiency; • Extended deployment of rail management IT systems; • Bundling of SWL flows by integrating further railports and other rail logistics; • Increasing involvement of SWL customers (e.g. IBS members) in SWL production to secure "critical mass".

Source: HaCon

[2] Implementation plan for the Corridor Zeebrugge-Antwerp/Rotterdam-Duisburg-[Basel]-Milan-Genoa – Draft Version 04.04.2013

2.2.3 Main SWL markets (Germany)

The analysis of the German single wagonload market is essentially based on available data from the Federal Statistical Office (DESTATIS) and the forecast "Prognose der deutschlandweiten Verkehrsverflechtungen 2025" which is used for strategic planning of traffic infrastructure in Germany. Based on the NSTR nomenclature, the shares of transported commodities for the time frame 2000 to 2010 as well as the forecast by 2025 is shown in Figure 9.

Figure 9: Commodity split in SWL transport in Germany

Commodity	Year								Variation	
	2000		2005		2010		2025		2010-2025	
	Mio. t	share	Mio. t	share	Mio. t	share	Mio. t	share	Mio. t	Trend
Agricultural products and live animals	7.5	9%	5.6	7%	5.7	7%	4.4	5%	-1.3	↘
Foodstuffs and animal fodder	2.5	3%	1.6	2%	1.8	2%	1.7	2%	-0.1	→
Solid mineral fuels	3.0	4%	2.1	3%	1.8	2%	0.8	1%	-1.0	↓
Petroleum products	4.7	6%	6.3	8%	6.6	8%	4.3	5%	-2.3	↘
Ores and metal waste	3.2	4%	2.9	4%	3.0	4%	2.1	3%	-0.9	↘
Metal products	27.4	33%	24.0	30%	**26.8**	32%	**23.5**	29%	-3.3	↘
Chemicals	15.6	19%	17.4	22%	**16.7**	20%	**18.1**	22%	1.4	→
Crude and manufactured minerals, building materials	9.0	11%	9.3	12%	**10.4**	12%	**7.7**	9%	-2.7	↘
Fertilisers	0.8	1%	0.7	1%	0.6	1%	0.5	1%	-0.1	↘
Machinery, transport equipment, manufactured and miscellaneous articles	9.9	12%	10.0	13%	**10.4**	12%	**18.4**	23%	8.0	↑
TOTAL	83.6	100%	79.9	100%	83.8	100%	81.5	100%	-2.3	→

Legend	↑	> +35%	↗	> +10% to +35%	→	> -10% to +10%	↘	> -35% to -10%	↓	< -35%

Source: HaCon based on DESTATIS and "Prognose der deutschlandweiten Verkehrsverflechtungen"

Market situation 2010

Based on 2010 figures, the single wagonload market in Germany is dominated by four commodities representing more than 76% of the national and international transport volumes:

- "Metal products" have a transport volume of 26.6 million tonnes which is equal to a market share of almost one third of the total SWL market in 2010;
- the second most represented commodity is "Chemicals" (16.7 million tonnes) with a share of 20%;
- "Machinery, transport equipment, manufactured and miscellaneous articles" and "Crude and manufactured minerals, building materials" (each with 10.4 million tonnes).

The remaining six commodities account for only 24% of the transport volume (19.7 million tonnes).

Market situation 2025 (expected)

For 2025, significant volume declines are predicted in almost all commodity groups. Based on tonnes this applies in particular for

- “Metal products” (-3.3 million tonnes);
- “Crude and manufactured minerals, building materials” (-2.7 million tonnes), “Petroleum products” (-2.3 million tonnes) and
- “Agricultural products and live animals” (-1.3 million tonnes).

Increasing volumes are expected for

- “Chemicals” (+1.4 million tonnes) and
- “Machinery, transport equipment, manufactured and miscellaneous articles” (+8.0 million tonnes).

According to current prognoses, the total SWL transport volumes will decline by 2.3 million tonnes until 2025, compared to 2010.

Market situation 2013

Observations and estimations of relevant market stakeholders (in 2013) revealed the following **current market trends** relevant for SWL transport in Germany:

- Production in steel industry is going down caused e.g. by decreasing sales volumes in the automotive industry.
- The printing and paper industry is faced with decreasing demand due to the trend to paperless offices and electronic reading. DB Schenker Rail is particularly affected because the company relies to a great extent on single wagonload traffic, which plays an important role for this industry.
- The transport volumes of potash, salt and fertilisers are stable.
- Chemicals are slightly increasing; experts estimate a yearly growth rate of +1.5%. Consignment sizes in the chemical industry are getting smaller because production plants in Germany and Central Europe are switching their production more and more from basic to special chemicals. As a result, lower volumes are shipped more frequently, which increases the trend towards SWL.
- The implementation of railports leads to a trend of slight growth in transport volumes in trade lanes where such logistics and transhipment nodes are involved.

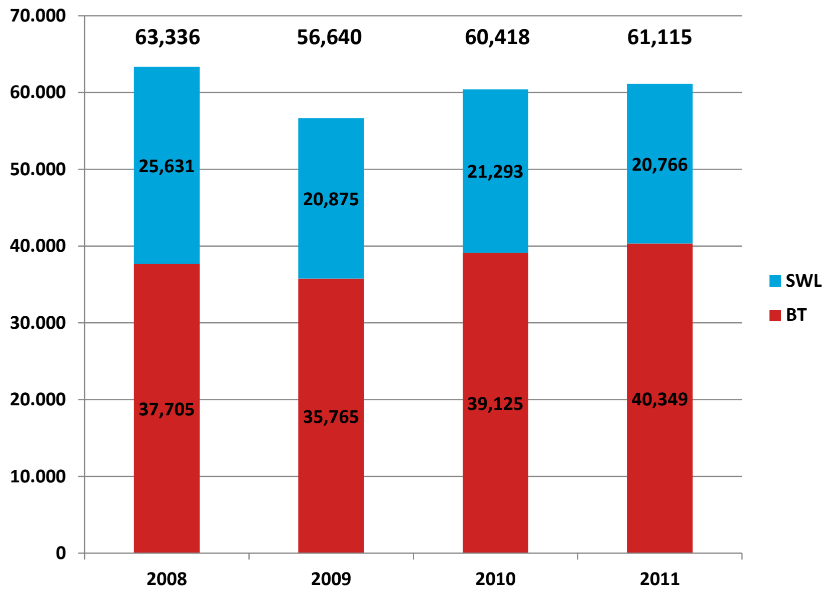
2.3 Switzerland

2.3.1 Transport volumes and modal split (Switzerland)

Main rail freight operator in Switzerland is SBB Cargo which shares the market with BLS Cargo, Crossrail (mainly involved in intermodal transport) and TX Logistik. Minor market shares are held by Captrain and railCare. The market for single wagonload transport in Switzerland is dominated by SBB Cargo.

The development of transport volumes and transport performance in rail freight transport in Switzerland based on EUROSTAT-data for the time period 2008 to 2011 are shown in Figure 10 and Figure 11.

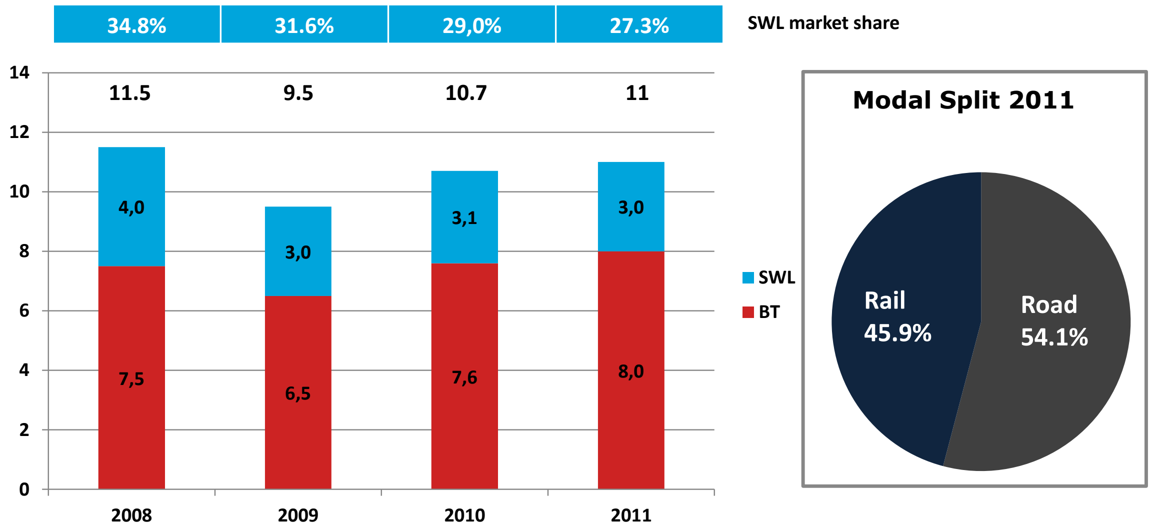
Figure 10: Evolution of rail freight transport volumes in Switzerland 2008-2011 [in thousand tonnes]



Source: HaCon based on EUROSTAT data

Figure 11 (next page) shows the total transport performance for rail freight in Switzerland. In the time from 2008 to 2011 these figures were more or less stable. Except the "crisis year" 2009, the value amounts to roughly 11 billion tonnes-kilometres. The transport performance of SWL decreased from 4 billion tonne-kilometres in 2008 to 3 billion tonne-kilometres in the following years. In 2011, rail freight had a modal share of almost 46% which is quite high compared to other European countries. Road transport amounted to 54%.

Figure 11: Evolution of rail freight transport performance in Switzerland 2008-2011 [in billion tonne-kilometres] and modal split 2011

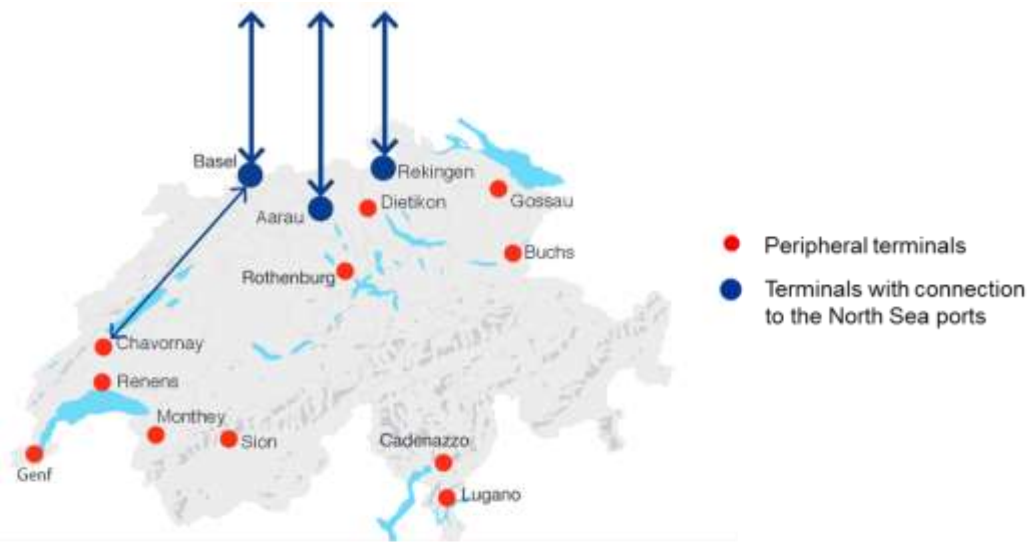


Source: HaCon based on EUROSTAT data

2.3.2 SWL organisation framework (Switzerland)

SWL in Switzerland is facing the same problems concerning cost efficiency like other European countries. In 2012, SBB Cargo restructured the SWL production network. From previously more than 500 served service points (stations + sidings), about 130 – that were not utilised sufficiently - have been closed. This has led to a loss of only 2% of the total rail freight volume in Switzerland. In parallel, SBB Cargo has expanded the SWL services. Under the name "Swiss Split", an offer for the distribution of maritime containers via the SWL network has been developed (cp. Figure 12).

Figure 12: Swiss Split concept



Source: SBB Cargo

Import containers from the North Sea ports (e.g. Hamburg, Bremerhaven, Rotterdam, Antwerp) with destinations in Switzerland are transhipped via the gateway terminals Basel, Aarau or Rekingen and the domestic Swiss rail network to the customers' rail sidings. 90% of the maritime containers are transported according to the Swiss Split concept. Only 10% of the containers are transferred to the customers via domestic intermodal terminals and last mile road transport. The transport chain for export containers is vice versa. Within Swiss Split, SBB Cargo currently delivers a daily average of 160 containers (120 wagons) to their customers. For the further improvement of international single wagonload transport from/to Switzerland, SBB Cargo participates in the Xrail alliance.

The current status and trends of SWL in Switzerland are summarised in Figure 13.

Figure 13: Status and perspectives of SWL transport in Switzerland

Switzerland	Main characteristics / trends
Current status	• SWL share on rail freight: 27% (2011) = 13% of total freight transport in Switzerland; • SWL production system / network restructured: 130 out of 500 service points closed; • Swiss Split concept for the distribution of maritime containers via the domestic SWL network.
Main perspectives / improvements	• Introduction of Xrail standards to raise quality and efficiency on international relations; • Stronger promotion and further development of Swiss Split system; • Infrastructure development according to Swiss terminal/hub strategy (Limmattal, Basel-Nord); • Introduction of technological innovations for rolling stock (locomotives + wagons), e.g. enabling automatic brake tests.

Source: HaCon

2.3.3 Main SWL markets (Switzerland)

The data on the Swiss SWL market is presented in section 4.2. The information summarised there represents the SWL market structure of SBB Cargo and Switzerland.

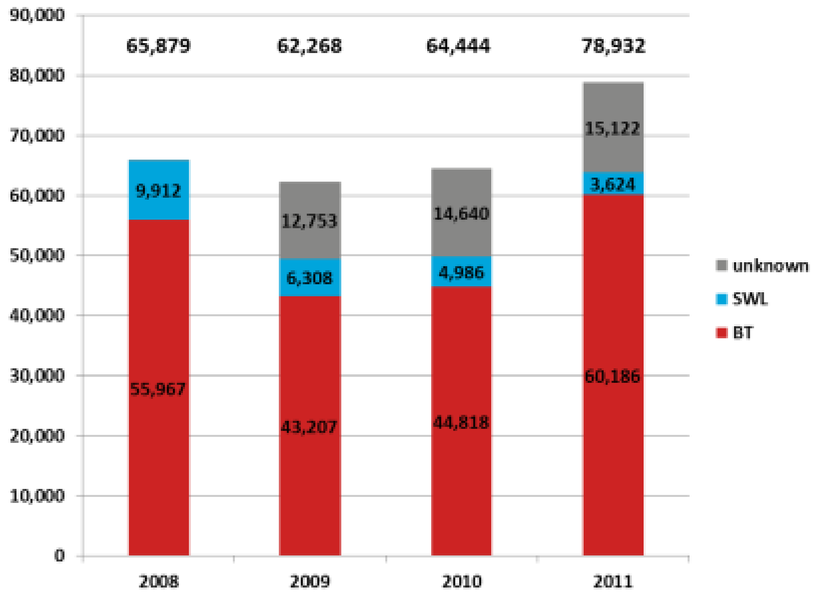
2.4 Italy

2.4.1 Transport volumes and modal split (Italy)

In Italy, Trenitalia Cargo is the market leader for rail freight services. Further rail freight operators on the Italian market are NORDCARGO as a part of the DB Schenker Rail Group, Crossrail, Rail Traction Company, Rail Cargo Italia, SBB Cargo Italia and roughly 10 smaller railway undertakings.

The developments of transport volumes and transport performance in rail freight in Italy - based on EUROSTAT data for the time period 2008 to 2011 - are shown in Figure 14 and Figure 15.

Figure 14: Evolution of rail freight transport volumes in Italy 2008-2011 [in thousand tonnes]

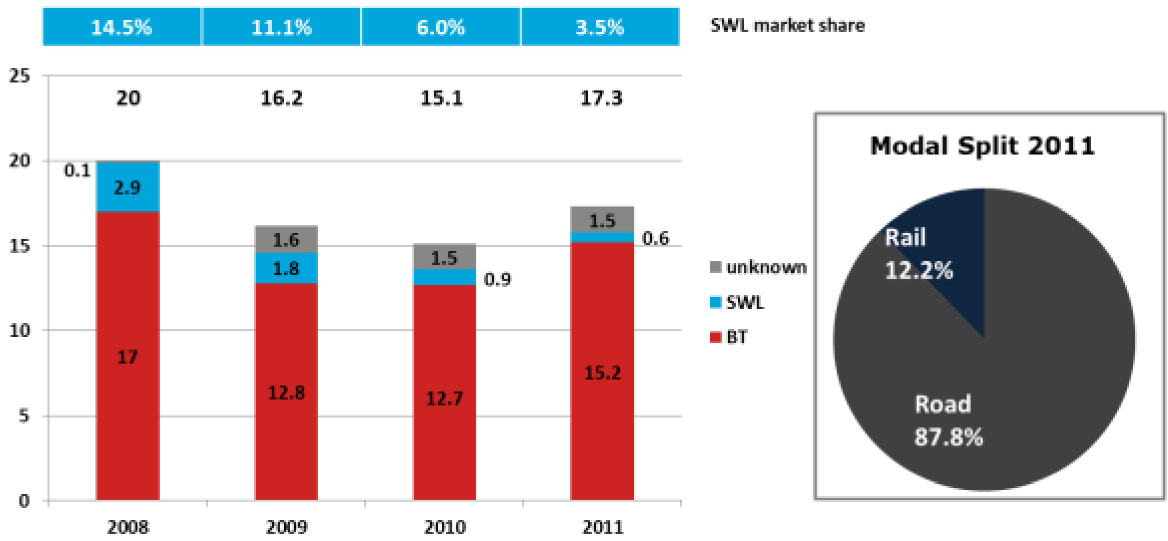


Source: HaCon - based on EUROSTAT data

Figure 15 (next page) shows the total amount of transport performance for rail freight services in Italy for the time frame 2008 to 2011. It has to be noted that the data for Italy has a significant share of traffic volumes (about 10% for 2009, 2010 and 2011) which could not be allocated accurately.

Based on the transport performance in 2011, rail freight had a share on the modal split of only 12%. Road transport amounted to 88%, IWT can be neglected.

Figure 15: Evolution of rail freight transport performance in Italy 2008-2011 [in billion tonne-kilometres] and modal split 2011



Source: HaCon - based on EUROSTAT data

Between 2008 and 2011, the transport performance in SWL service declined by almost 80% from 2.9 billion tonne kilometres in 2008 to 0.6 billion tonne kilometres in 2011. In the same time, the market share of SWL dropped down from 14.5% in 2008 to 3.5% in 2011. A considerable reduction has to be recorded in the period 2009-2010 as the market share was nearly halved from 11.1% to 6.0%. This was caused by restructuring measures for SWL services of Trenitalia Cargo. In fact, Trenitalia gave up the classic SWL production system and concentrates on so-called "multi-customer" services between important economic centres in Italy.

2.4.2 SWL organisation framework (Italy)

As indicated before, Trenitalia Cargo has started a radical restructuring process of its single wagonload production system. As of April 2010, Trenitalia has reduced the total number of service points and from thereon has been concentrating on the main industrial areas of Italy. Besides this, the transportation of dangerous goods by single wagonload has been stopped. As a result, the 2010 figures revealed a substantial reduction for SWL transport compared to 2009[3]:

- in terms of train-km -54.5%;
- in terms revenues -46.5%.

In contrast, block freight trains recorded a slight growth:

- of in terms of train-km +4.2%;
- in terms revenues +8.3%.

[3] Trenitalia S.p.A. Financial Statements, 31 December 2010

For customers requiring the transport of smaller freight volumes, a new rail freight offer ("multi-customer") has been set up serving only specific stations in the main Italian economic centres. Currently, the following trade lanes are served:

Figure 16: Overview on "multi-customer" services in Italy

Trade lane	Frequency (status: 12/2012)
Torino-Pescara-Melfi	5 weekly connections
Turin-Fossacesia	3 weekly connections
Pescara-Catania	1 weekly connection
Dinazzano-Marcianise-Lamezia	1 weekly connection
Castelguelfo-Marcianise	1 weekly connection
Milan-Marcianise	3 weekly connections
Prato-Marcianise	3 weekly connections
Pisa-Bari	2 weekly connections

Source: HaCon - based on Trenitalia information, status 12/2012

Forthcoming links shall be Castelguelfo-Bari (1 weekly connection); Faenza-Marcianise (1 weekly connection) and Torino-Marcianise (5 weekly connections)[4].

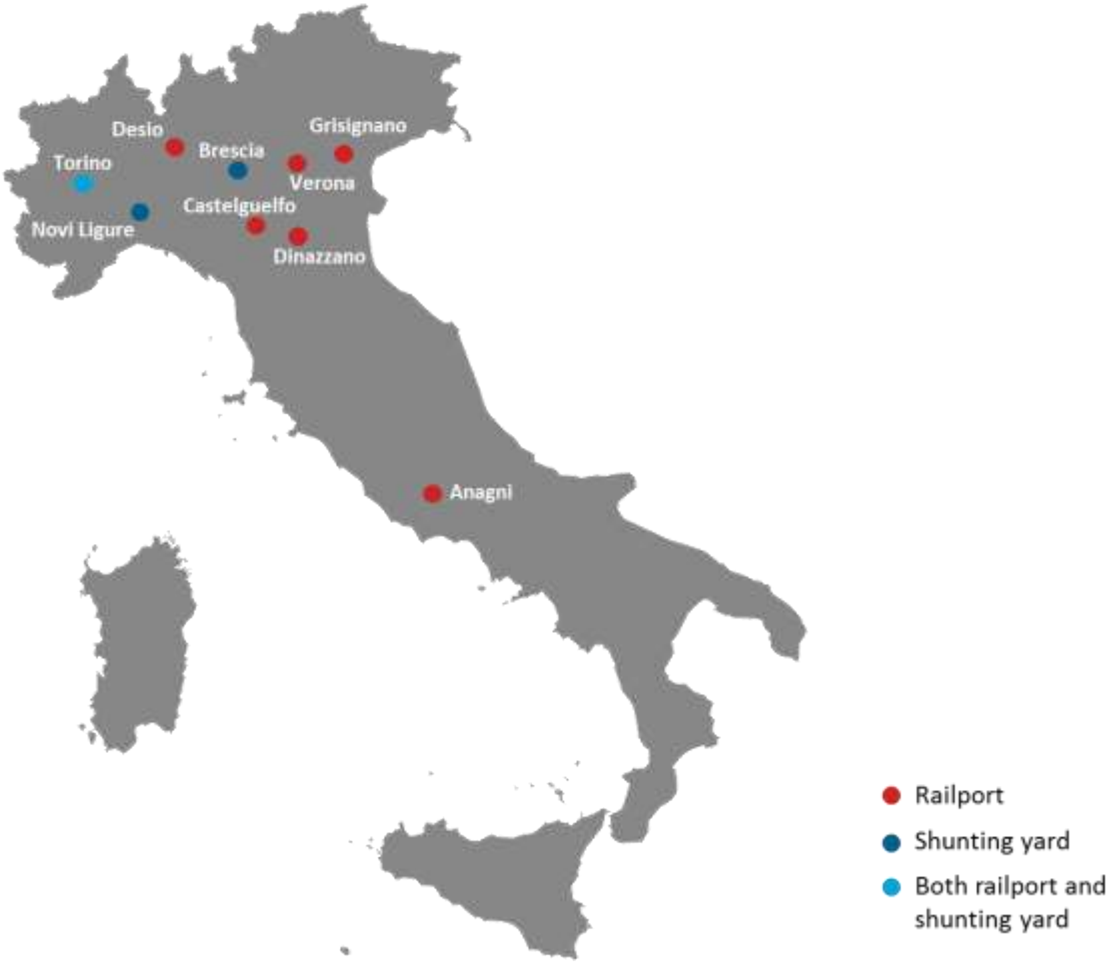
[4] Ship2Shore- On line magazine of maritime and transport economics – Issue no. 49/17.12.2012

Figure 17: Existing and planned domestic SWL connections of Trenitalia

Source: HaCon - based on Trenitalia information, status 12/2012

Since the restructuring of the SWL network of Trenitalia, other railway undertakings serve destinations in Italy on their own. For example DB Schenker Rail together with partner railway undertakings connects Italy to their international SWL services via railports which are mainly located in Northern Italy (Torino Orbassano, Desio, San Zeno, Castelguelfo, Dinazzano, Anagni, Verona, Grisignano, Lugo di Romagna – status: October 2013).

Figure 18: Main SWL production nodes of DB Schenker Rail in Italy



Source: HaCon based on DB Schenker Rail information, status 11/2013

In summer 2013, Xrail announced to expand their network to Northern Italy in co-corporation with the alliance partners' Italian branches. NORDCARGO, belonging to DB Schenker Rail will start to offer the Xrail standards during the course of 2013. Rail Cargo Italia, belonging to the Rail Cargo Group, intends to start serving Northern Italy in the beginning of 2014. Altogether, about 30 stations in Italy shall be integrated into the network which will be served according to Xrail quality standards.

At the same time, Fret SNCF - which has not entered the Xrail consortium - is envisaging to set up a distribution platform in the North of Italy for long distance wagonload traffic.

The current status and trends of SWL in Italy are summarised in Figure 19.

Figure 19: Status and perspectives of SWL transport in Italy

Italy	Main characteristics / trends
Current status	• SWL share: 6% on total rail freight transport in Italy (estimated); • Operation of the "classic" SWL production system / network was stopped by Trenitalia in 2010; • Trenitalia offers "multi-customer" services between main economic centres in Italy (some 10 relations); • No transport of dangerous goods in SWL; • Southern Italy almost cut-off from SWL offers.
Main perspectives / improvements	• Set-up of new SWL service network in Northern Italy by Xrail alliance partners as of 2013; • Introduction of Xrail standards in Northern Italy planned for 2014; • Different European operators and initiatives tackle SWL in Italy to revitalise this type of rail freight services.

2.4.3 Main SWL markets (Italy)

The European and the national statistics offices EUROSTAT and ITALSTAT do not provide detailed information on the structure of the Italian rail freight market. Therefore the analysis of the Italian rail market is based on two sources:

- a market observation of Trenitalia (for 2010) focussed on the development of the most important rail-affine commodity groups (published in the Financial Statement of Trenitalia, 31 December 2010) and
- a market assessment of relevant stakeholders of the European and Italian SWL business. The information has been gathered in April 2013 within the ViWaS workshop on "Single wagonload traffic in Italy" in which particular market potentials of SWL in Italy and their exploitation have been discussed.

Market situation 2010 (according to Trenitalia[5])

In 2010, the most relevant commodity groups for Trenitalia Cargo and their respective development (compared to 2009 figures) are described below:

- Metal products: The Italian iron and steel industry recorded an overall growth of 6.5% for long products and 41.8% for semi-finished flat steel products. This affected rail freight traffic as follows: increase of 12.9% in terms of train-km and 20.5% in terms of revenues.

[5] Trenitalia S.p.A. Financial Statements, 31 December 2010

- Automotive: The European car market recovered from the effects of the worldwide economic crisis. In Italy, registrations of new cars decreased by 9.2% compared to the 2009 volumes that were positively affected by grants awarded by the Government. However, rail freight volumes in the automotive industry had an increase of 15.8% of train-km compared and 17.9% in terms of revenues mainly caused by the raise of exports from Italy to Poland.
- Chemicals: Train-km recorded a decrease of 13.6%, while revenues decreased by 24.3%. This cutback was effected by the reduction of production of the Italian chemical industry, the completely shutdown of two chemical plants as well as by regulatory changes and new operating procedures relating to the transport of dangerous goods.
- Other sectors: Raw materials (e.g. clay and cereals) and large consumer goods had an increase 4% in terms of train-km and 13.6% in revenues.

Market perspectives 2013 (conclusions from ViWaS workshop)

The perspectives of the Italian SWL market have been discussed by the project partners and further major stakeholders during the ViWaS workshop on 9 April 2013 in Bologna. As a result, the following important commodities and trade lanes have been identified:

- Steel and steel products: Rail has a high share on the transport of steel pre-products coils and scrap. This also includes scrap metal transports which partly use the rolling motorway across the Alps.
- Foodstuffs such as tomato sauce, mineral water, milk and bottled mineral water. The Italian food industry offers high volumes potentially transported by SWL.
- Waste like paper and urban waste with significant transport flows between Northern and Southern Italy (e.g. Naples).
- Building material like clay and ceramic. The transport of raw material (clay) for the ceramic industry in Italy from Germany and the transport of final products (tiles) to Germany and Northern Europe offer significant potentials for SWL transport.
- Agricultural products like turf from Northern Germany to Italy, e.g. for gardening companies in the Bologna and Naples regions. For these goods, road hauliers currently offer very competing prices.
- Consumer products like home appliances ("white products") and consumer electronics ("brown products"). Especially, consumer products offer a high affinity to SWL services from Italy to Northern Europe. In these trade lanes, rail has lost market shares in the last years as the structure of trade due to the concentration in retail had changed significantly. The distribution centres of discounters and big trade chains often do not have sidings.

- The transport of dangerous goods is very restrictive in Italy with respect to rail transport. For instance, it is not allowed to operate dangerous goods via freight villages (Interporti).

The results of the workshop will be considered in the further ViWaS project work and for the setup of appropriate business cases. In order to obtain an in-depth view of the Italian rail freight market, it is also foreseen to elaborate a market study within WP 5 in which freight flows and market potentials shall be analysed in detail.

2.5 France

2.5.1 Transport volumes and modal split (France)

In France, the biggest rail freight operator is Fret SNCF together with its subsidiary VFLI. Important competitors are Colas Rail, Euro Cargo Rail (part of the DB Schenker Rail group) and Europorte France. Moreover, there are further small railway undertakings focussing on regional offers.

2.5.2 SWL organisation framework (France)

Until 2009, Fret SNCF offered a comprehensive SWL service network. As in other European countries and accelerated by the economic crisis in Fret SNCF has determined that the company's production system for SWL was no longer economically viable. The single wagonload service generated 30-40% of the division's annual turnover but accounted for 70% of its losses. Transport volumes continued to decrease since 2000 from some 60 billion tonne kilometres plummeting to some 40 billion tonne kilometres (about 500,000 wagonloads) in 2008 and dropped down to a low point of 30 billion tonne kilometres in 2010. In 2011, the SWL transport market in France saw a slight increase to 34 billion tonne kilometres. Factors for this recovery could be the market entrance of private railway undertakings and the restructuring of the Fret SNCF's rail production system.

At the end of 2010, Fret SNCF has introduced the new "Multi-Lots Multi-Clients" (MLMC) rail production system in response to their economic requirements and the customers' needs with respect to transport performance. According to Fret SNCF, the following benefits have been achieved:

- considerable improvement of transport quality (reliability, punctuality, transport time) compared to the previous production system;
- guaranteed capacity;
- optimised domestic geographical coverage including trans-European connections.

The MLMC concept

The MLMC system consists of a set of independent lines that provide regular links between the major economic regions in France (cp. Figure 20, next page). Each link is made up of a connecting train and local distribution services. MLMC considers reciprocal agreements: the shippers commit to a minimum anticipated amount in the order process and Fret SNCF commits to the transport deadline. All operations are based on a transport plan. An important supporting module is a web-based information system which facilitates for customers processes (pre-orders, complaints, monitoring etc.).

At operational start in 2011, the MLMC system is characterised by the following key figures:

- 215,000 loaded wagons, operated on 30 lines with 400 weekly trains;
- 500 service points;
- 185 clients.

The system secures a high grade of reliability: 80% of the loaded wagons are delivered on time and 90% within 24 hours of the scheduled delivery time.

Figure 20: Multi-lots Multi-clients network of Fret SNCF for SWL

Source: Fret SNCF'S single wagonload offer – May 2013

In 2012, the MLMC transport volumes decreased to 180,000 loaded wagons. This was reasoned by the loss of an important client, namely Gefco, the logistics division of PSA Peugeot-Citroen. Gefco cancelled its freight contract with Fret SNCF because the MLMC-system was not matching their expectations[6]. This leads to a loss of 40,000 wagons per year that were transferred to a competing railway undertaking. In fall 2012, Fret SNCF extended the MLMC network with international connections between Woippy (France) and Antwerp (Belgium), Ruhr, Cologne (Germany) and Switzerland, providing an end-to-end service.

[6] ACTU Fret Bulletin n°61 – Mai 2012

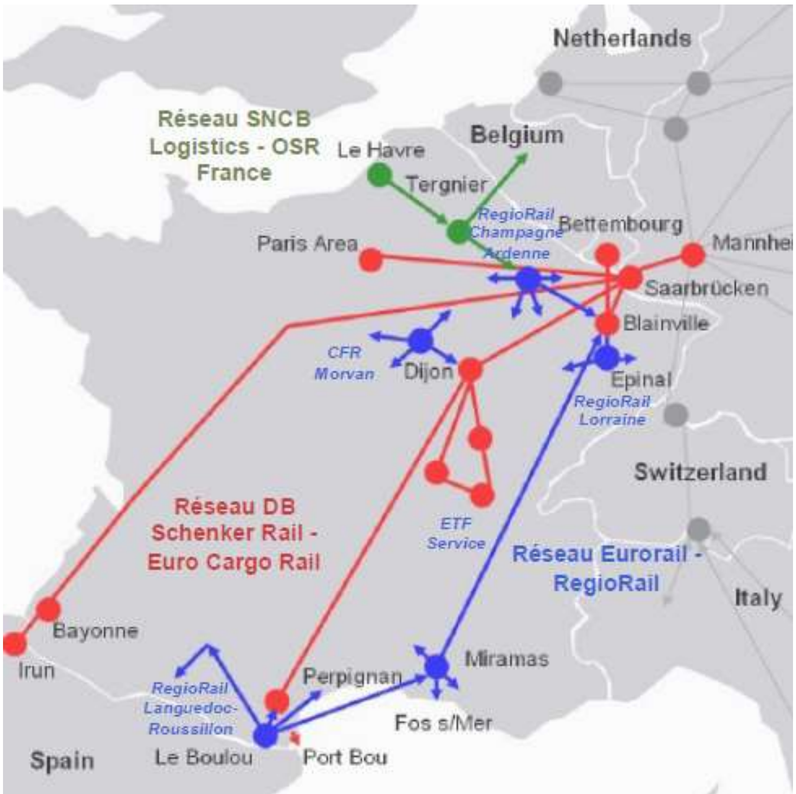
Other wagonload networks

It is estimated that in 2012, roughly 70,000 loaded wagons were operated by competitors of Fret SNCF that is equal to a market share of almost 30% on SWL transport.

After stopping the contract with Fret SNCF, Gefco together with Euro Cargo Rail, Colas Rail and Europorte set up a new rail transport network, mainly dedicated for finished cars. This system is organised via the hubs Acheres and Gevrey.

The second network is mainly composed of Xrail alliance partners and their French branches (SNCB / OSR France, DB Schenker Rail / ECR) and local rail freight operators (so called OFPs, e.g. CFR Morvan, ETF, Eurorail, RegioRail). These organisations collaborate to progressively developing the new network according to the scheme described in Figure 21. For international transports the system will be connected to the Xrail network; specific regions are served by the local OFPs. In future potentially some 25 OFPs shall be integrated in the network.

Figure 21: Planned wagonload networks in France outside Fret SNCF



Source: Eurorail – RegioRail, 2013

According to RFF[7], the following main infrastructure facilities for wagonload operations are provided in France:

- 5 shunting yards, namely Le Bourget (region Ile-de-France), Miramas (Provence-Alpes-Cote d'Azur), Sibelin (Rhone Alpes), Woippy (Lorraine), Dunkerque (Nord-Pas-de-Calais);
- 2,400 sidings.

Figure 22: Status and perspectives of SWL transport in France

France	Main characteristics / trends
Current status	• SWL share: 14% on total rail freight transport in France (estimated); • Operation of the "classic" SWL production network significantly reduced; • Since 2010 Fret SNCF offers the MLMC production system; • Other rail freight operators already have a significant market share in SWL (some 30% in 2012).
Main perspectives / improvements	• Competing railway operators/OFPs are developing an alternative SWL production network; • Step-wise extensions of MLMC network of Fret SNCF; especially international connections e.g. to Italy will be further developed.

2.5.3 Main SWL markets (France)

After a major decrease in number of wagons transported in wagonload activity from 750,000 in 2007 to roughly 220,000 in 2013, the major remaining markets for single wagonload transport in France are classically steel, chemicals and automotive. Other commodities are for instance petroleum products, building material, agricultural products (e.g. cereals collected in different silos) and foodstuffs (e.g. mineral water).

Details on the market structure of Fret SNCF – that is still the dominating market actor - are presented in section 4.3.

[7] Network statement of the national rail network, "2014 timetable", Réseau Ferré de France (RFF), Version 3 of 26 April 2013

3 SWL cost structure

This chapter describes the relevant cost components of SWL transport and investigates their share and impact on the total transport costs. This exercise has been carried out based on

- existing studies and the expertise of the ViWaS partners (general cost structure);
- selected "realistic" SWL transport chains (case studies) of the ViWaS partners, in which the respective cost components are analysed in comparison to intermodal transport.

Main parameters and potential measures for improving the competiveness of single wagon transport chains have been identified and evaluated regarding their potential influence on cost reductions.

3.1 Cost types

For the provision of primary rail freight transport services, the following cost types are distinguished[8]:

- traction vehicle, locomotive;
- track access charges;
- wagon costs;
- traction energy and
- personnel costs.

Additional costs e.g. for marketing, office organisation, contract management (overhead costs) occur indirectly. The aforementioned primary costs can be examined in detail:

Traction vehicles

Costs for locomotives depend mainly on the type of locomotive. Particularly, it needs to be distinguished between shunting locomotives and long haul locomotives. A second criterion is the type of propulsion – electric or diesel.

There are several models of financing rolling stock. Besides the "classic" purchase, there are models to lease or rent vehicles. They are especially interesting for new market entrants and for the fulfilment of short term carriage contracts. Depending on the predicted utilisation of the locomotive it is important for the RU to decide whether to rent or to buy. Also expenses for maintenance need to be considered.

[8] *Wittenbrink, P., Hagenlocher, S.(2012), Kalkulation von Schienengüterverkehrsleistungen, Privatbahn-Magazin 03/2012, S. 30f.*

Track access charges

Access charges arise for the use of railway infrastructure of the respective infrastructure manager. This relates to route charges as well as user fees in nodes such as terminals and marshalling yards. Additional fees may apply in particular to single wagonload transport for the use of electrical outlets, humps or air pumps.

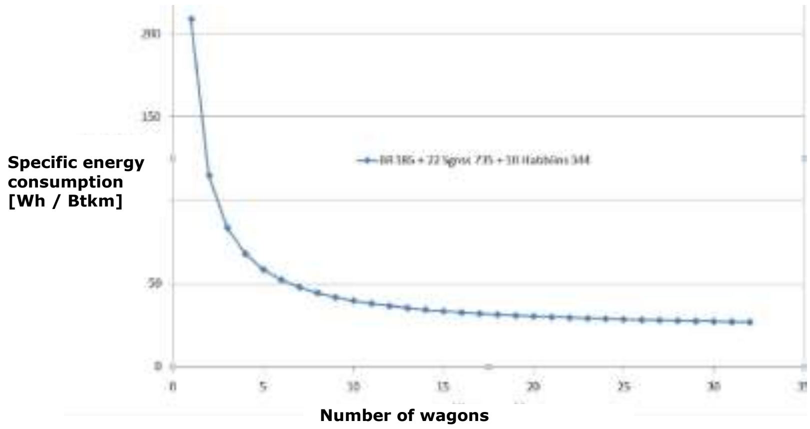
Freight wagons

Costs for freight wagons apply usually as a daily charge since they are longer bound to a particular transport as for example the locomotive. While wagons are being shunted or wait for unloading, the locomotive is free to be used for another task.

Traction energy

Energy costs are interrelated with the type of locomotive (diesel, electric) and with its specific energy consumption. One significant factor is the topography of the track. The energy consumption of freight trains is significant higher in mountainous regions compared to flat lands. Energy consumption rises with the train length. The relative energy consumption per wagon, however, decreases with a rising train length (cp. Figure 23)

Figure 23: Number of wagons in a train vs. energy consumption[9]



Source: Bauer, T.

Personnel costs

For operating a train, a driver is required. Depending on the length of the journey, several qualified drivers are needed, and shift changeovers and breaks need to be regarded. In single wagonload transport, additional labour costs occur when processing trains in marshalling yards.

[9] *Bauer, T. (2013): Integriertes Produktionskonzept des Wagenladungs- und des kombinierten Verkehrs. Bachelor's Thesis. Technische Universität Berlin. Chair of Track and Railway Operations.*

3.2 Wagonload production systems and cost components

Today's single wagonload transports are operated in bundling networks in most European countries. As shown in Figure 24, different tasks are assigned to each node in the network to follow a hierarchical system.

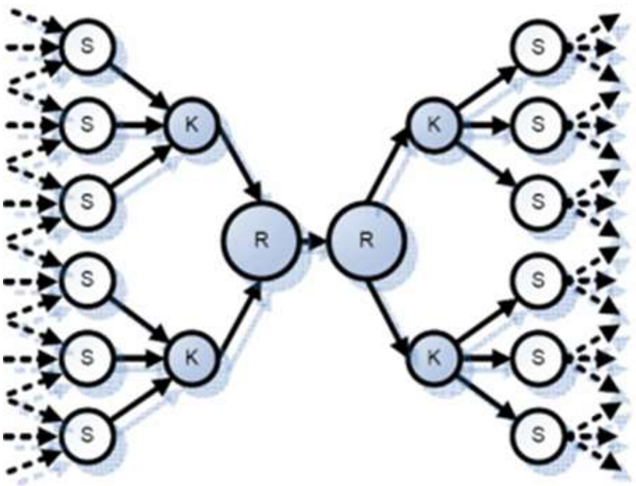
In this system **satellites** are the smallest collection/distribution points. Here loading and unloading of goods is performed. These stations usually possess neither own shunting vehicles nor personnel.

Several satellites are connected to a **collecting node**, which is the control centre for the management and control of transport processes in wagonload transport.

In major **marshalling yards**, freight wagons are collected and formed to longer trains. Between two major marshalling yards, long distances are usually covered. Consequently, marshalling yards form the interface between local and long-distance transport.

Within the node system, shunting is allocated to **collecting nodes** and **marshalling yards**. This leads to a higher automation of the processes and increased efficiency. Locomotives and personnel can be better planned which leads to an increase in productivity. The bundling of traffic can, however, also lead to detours and thus to higher wagon kilometres. To minimise detours, flexibility has been added to the node system: When traffic volume is high enough, direct trains are allowed between minor nodes omitting the big hubs.

Figure 24: Hierarchical bundling network in single wagonload



Legend: S) Satellites, (K) Collecting nodes, (R) Major marshalling yards Satellites, (K) Collecting nodes, (R) Major marshalling yards

Source: Bundesministerium für Wirtschaft und Technologie (2009): Projektbericht FlexCargoRail.

In a hub system, single wagonload transport consists of several elements:

(1) Local traction: collection and distribution of wagon in a region;
(2) Long haul traction: bundled transport on a main line;
(3) Marshalling yard: collection, sorting, train formation.

Each element in a SWL transport chain generates costs that can be analysed separately. Further cost components that affect the whole transport arise in addition. A composition of cost components for a single wagonload transport is represented in the Figure 25.

Figure 25: Cost components for a single wagonload transport

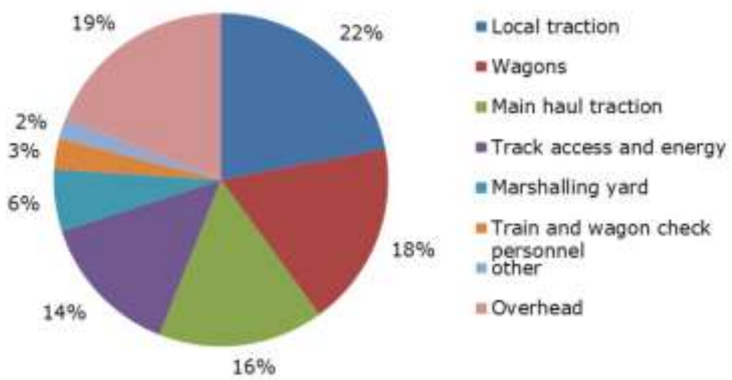
Local traction	Long haul traction	Marshalling yard
• locomotive • personnel costs • track access charges • traction energy • overhead costs	• locomotive • personnel costs • track access charges • traction energy	• incoming and outgoing journey per wagon • shunting • trains formation
Train check, car inspection		
Wagon costs		
Overhead (sales, marketing, administration)		

Source: Hagenlocher, S. et.al. (2013): Ableitung effizienter Organisationsformen im Schweizer Schienengüterverkehr in der Fläche. Bundesamt für Verkehr BAV.

3.3 Cost structures in single wagonload transport in comparison to combined transport

Research on cost structures in rail freight transportation has been carried out in several studies. Most recently, the study of *Hagenlocher, S. et.al. (2013)* evaluated the following structure of cost shares for single wagonload transport:

Figure 26: Estimated cost structure of a single wagonload transport system



Source: Hagenlocher, S. et.al. (2013): Ableitung effizienter Organisationsformen im Schweizer Schienengüterverkehr in der Fläche. Bundesamt für Verkehr BAV.

The depicted estimated cost shares of Figure 26 have been confirmed by own analyses, conducted within the ViWaS project.

Cost drivers in single wagonload transport are regularly the local traction or "last mile operations" such as shunting to and from final destinations but also the processes of sorting and train make-up in marshalling yards. Shunting procedures do not contribute to the transport itself and therefore do not contribute to the value[10].

In combined transport, however, shunting is avoided whenever possible. Transport by rail is carried out only on the long-distance relation between major hubs. The distribution in space is carried out by truck services. The less complex process structures in combined transport accordingly lead to less complex and lower costs compared to single wagonload transport.

3.3.1 Methodology and examined case studies

Differences in the production processes of specific single wagonload and combined transports result in quite diverse cost structures. Three specific case studies of the ViWaS members SBB Cargo and Bentheimer Eisenbahn have been analysed concerning their cost structures for both combined transport and single wagonload transport. For comparison reasons, costs were also estimated for the same relations, assuming truck haulage.

[10] *Kortschak, Bernd H. (2012): Rescue Single Wagon Load Traffic, Abolish Shunting! FOVUS 6th International Symposium Networks for Mobility. Stuttgart, 27.09.2012.*

The case studies 1 and 2 illustrate transports of retail goods in swap bodies within the Swiss railway network of a length of 139 km and 192 km respectively. Case study 3 illustrates the transport of turf from Northern Germany to Northern Italy in a length of approx. 1,200 km. For best comparison, the costs of all three examples have been scaled to an equivalent of one truckload:

Figure 27: Case studies - overview

Case study	Distance Rail	Distance Road	Transported goods
1	139 km	146 km	Retail goods in swap bodies (two swap bodies = one truckload)
2	192 km	182 km	Retail goods in swap bodies (two swap bodies = one truckload)
3	1,200 km	1,200 km	Turf (30 t = one truckload)

Source: TU Berlin based on data of SBB Cargo and Bentheimer Eisenbahn

The cost structures of the three case studies were examined for three potential transport chains:

(1) single wagonload transport;

(2) combined transport;

(3) transport by road.

The costs of the transports have been aggregated to three relevant cost blocks:

(1) Local haulage, last mile transport;

(2) Main haulage;

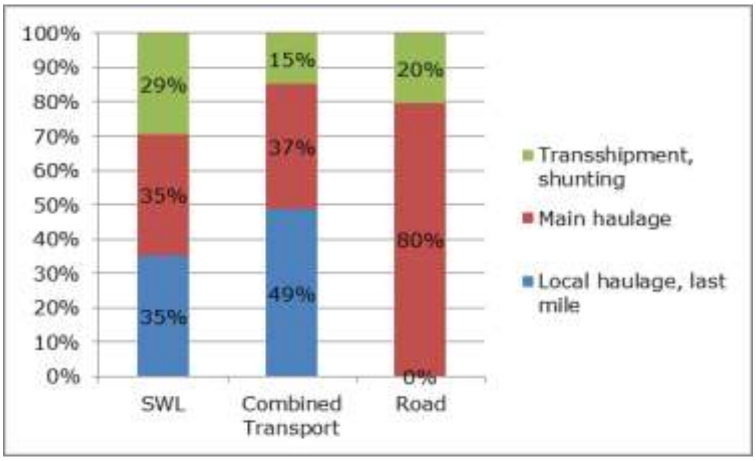
(3) Transhipment and shunting in hubs.

Data for the above case studies have been provided by the ViWaS partners (Bentheimer Eisenbahn and SBB Cargo) specifically for the SWL and combined transport chains. Costs for road transport are estimated with the support of experts in this market segment and consider the specific market conditions on the different trade lanes.

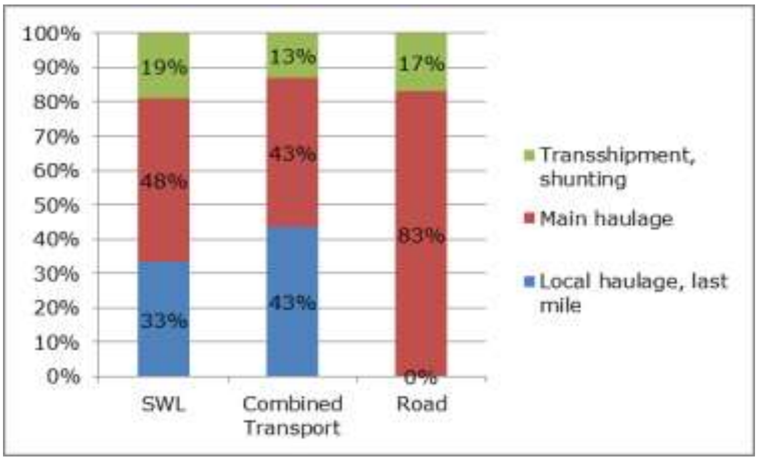
3.3.2 Relative cost structures (comparison of cost shares)

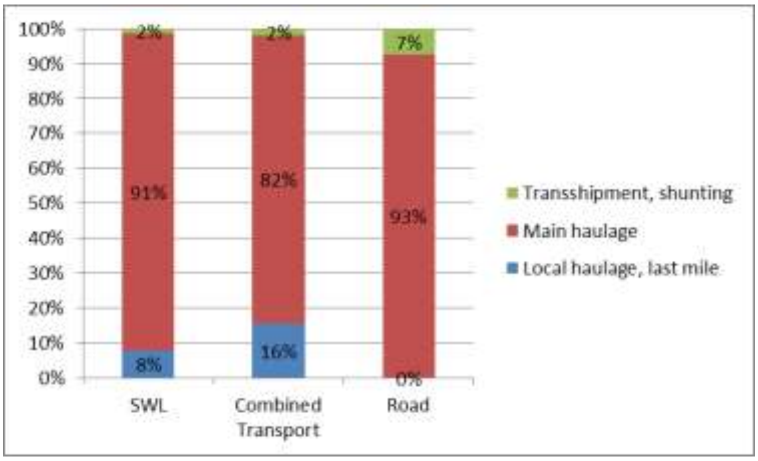
The relative cost structures show the distribution of costs among the three blocks (cp. Figure 28). For the case studies 1 and 2 – representing a typical inland transport chain – it becomes clear that the non-profitable costs of hub operations (transhipment, shunting) generate a significant part of the costs. With longer transport distance (see case study 3), the transhipment costs become less important. Also the costs of the last mile transfer have to be considered as critical in single wagonload transport, since they generate up to one third of the entire transport costs with comparably low distance overcome.

Figure 28: Cost distribution for different transport chains (SWL, intermodal road) within three case studies



Case study 1





Case study 2

Case study 3

Source: TU Berlin based on data of SBB Cargo and Bentheimer Eisenbahn

Combined transport allows reducing the costs of hub-internal cargo handling. However, the costs for the last mile operations tend to be higher. This is due to the fact that the costs on the main run are lower in combined transport whereby their share decreases.

Transport by road has the advantage of establishing a direct connection between the two endpoints of the transport. Thus, last mile costs do not occur and the major share of costs is consumed by the main haulage.

Relative costs do not provide all information required to understand cost structures of freight transport. Therefore, absolute costs are examined in the following section.

3.3.3 Absolute cost structures (comparison of total costs)

The three case studies have also been analysed regarding their absolute costs. The cost structures of Figure 29 show the distribution of costs among the three cost blocks.

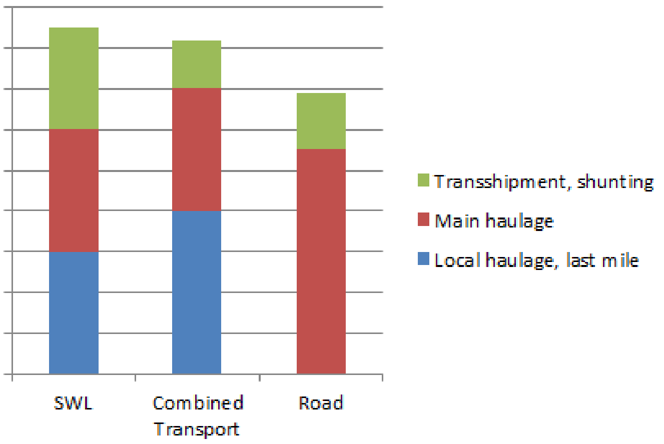
It is clear at first sight that costs rise with the transport distance. As a result, the share of main haulage dominates the total transport costs in case study 3. Due to very competitive prices for road transport on the trade lane between Germany and Italy and the complex collection and distribution processes for this specific case study, there is a significant price difference to be stated between SWL and road transport. Also in the case studies 1 and 2 with their relatively short distances, rail can hardly compete with road. Showcase 3 shows that despite the common opinion that single wagonload transport is cost efficient on long distances, it is strongly depending on the specific market and production conditions.

Combined transport services can be offered regularly at better terms compared to single wagonload transport. Although transhipment costs are higher there, the avoidance of shunting leads to equal or less overall costs.

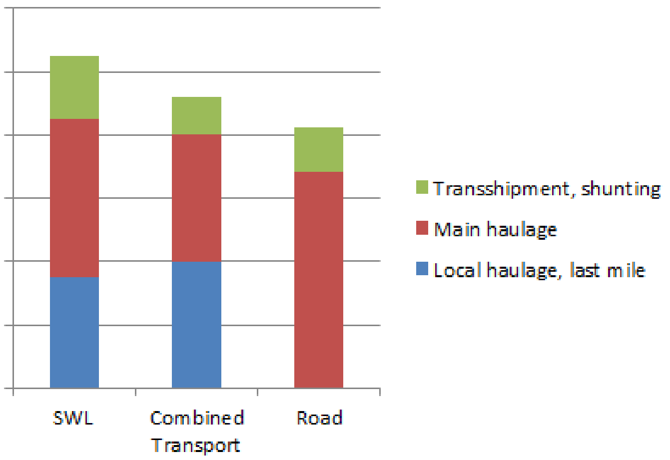
To enable competitive services for single wagonload transport in shorter distances, transhipment costs and the expenses for the last mile transfer need to be reduced significantly. Promising strategies to make single wagonload transport more competitive are described in section 3.4.

There are also approaches to lower costs during the main haulage. This includes the assignment of modern locomotives but also questions of aerodynamics and better capacity utilisation. Since these improvements apply not only to single wagonload transport but to rail freight transport in general they are not regarded in detail here.

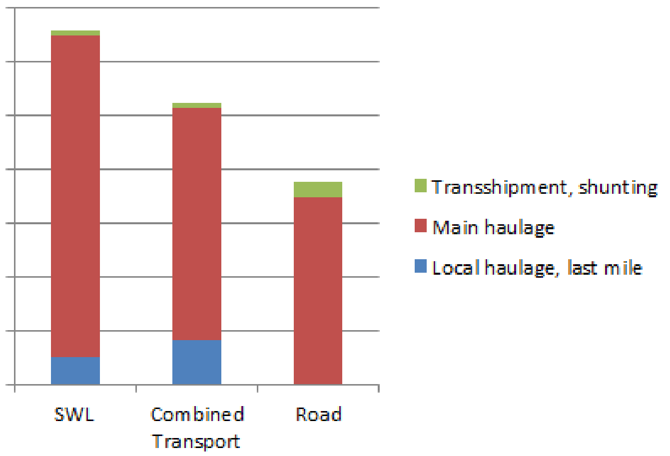
Figure 29: Total costs of different transport chains (SWL, intermodal road) within three case studies



Case study 1



Case study 2



Case study 3

Source: TU Berlin based on data of SBB Cargo and Bentheimer Eisenbahn

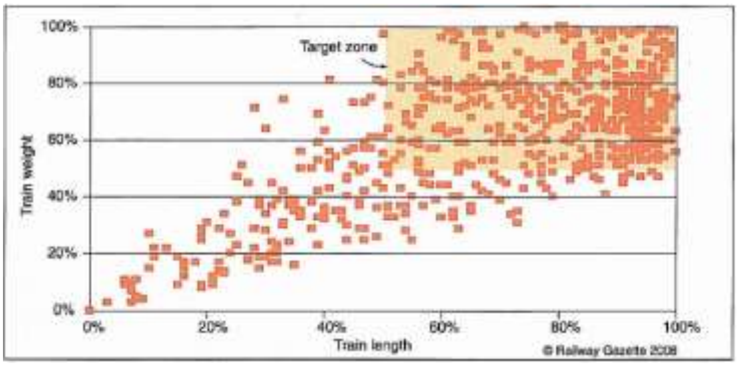
3.4 Strategies to reduce costs in single wagonload transport

Cost drivers in single wagonload transport are the last-mile service and the handling processes in freight yards. The issues addressed in this section shall have the goal to reduce costs in these areas but consider the single wagonload transport as a whole, too.

3.4.1 Train length

In single wagonload transport, trains are regularly shorter than the maximum allowed train length (cp. Figure 30). The cost function in railway operations contains a significant block of fixed costs (e.g. track access charges, locomotive operation hours or driving personnel) that occurs independently to the number of freight wagons carried by a train. This allows utilising economies of scale.

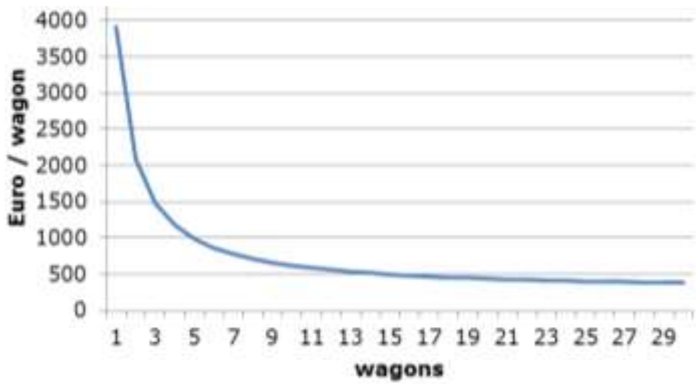
Figure 30: Use of tonnage and length limits in European rail freight operations



Source: Case, R. et.al. (2008) 'Mixed train' approach can lift wagonload profitability. Railway Gazette International (2) p. 92-93

Figure 31 shows that the costs per wagon decrease with the length of the train. Hence, train length is an important and powerful parameter to reduce costs in single wagonload transport.

Figure 31: Costs per wagon depending on the train length



Source: Adapted from Bauer, T. (2013): Integriertes Produktionskonzept des Wagenladungs- und des kombinierten Verkehrs. Bachelor's Thesis. Technische Universität Berlin. Chair of Track and Railway Operations.

A crucial drawback is the maximum allowed train length for international transports. While Denmark for example allows trains of up to 835 m, Italy allows one of 550 m., International transport accordingly does not utilise the maximum train length in at least one country. Since the maximum allowed train length derives mainly from infrastructural restrictions (short overtaking tracks, steep ascends etc.), it is a long-term approach to harmonise maximum allowed train lengths in the countries of Europe.

3.4.2 Stable and continuous volumes

Single wagonload transport is very sensitive to deviations on utilisation. *Hagenlocher, S. et.al. (2013)* points out that volume declines in particular lead to a significant cost increase. A bisection of the number of transported wagons (-50%) leads to an increase of the average transport costs per wagon by approximately 43%. A doubling of the transported wagons (+100%), however, leads to a reduction in the average transport costs per wagon of about 21%. This issue becomes obvious considering the regressive cost function of single wagonload transport and the associated economies of scale (see also section 3.4.1).

3.4.3 Shunting locomotives

Modern shunting engines which are economically and ecologically favourable can lead to better cost efficiency in single wagonload transport. Especially the last mile transport of a low amount of wagons from a siding to the first marshalling yard does not require a heavy locomotive with high energy consumption. Here, the use of light engines or bimodal rail-road vehicles can reduce costs in both, investment and in maintenance.

For areas where lines are only partially equipped with catenaries (electric power), hybrid engines are a possibility to enable through-going traction and to reduce shunting costs, again in both, investment and in maintenance.

Figure 32: Stadler hybrid locomotive and bimodal rail-road vehicle

Source: Stadler Rail AG

Source: Terberg-Nordlift GmbH

Today’s shunting operations are carried out by old locomotives built in the 1960’s and 1970’s. As most of them are coming to their end of life in the next years, there is a chance to exchange them with lighter and thus cheaper and more ecological variants. To support SME’s active in the single wagonload transport market incentives to foster investments in efficient, economical friendly shunting equipment should be considered.

3.4.4 Border crossing operations

Generally, rail freight transport becomes more efficient with increasing haulage distance. Therefore international relations become more and more important for rail freight.

In Europe the overcoming of longer distances generally goes together with the crossing of borders and thus with the change of railway systems. However, this is a general drawback of European railways in intermodal competition, a certain potential is seen in the cross-border harmonisation of the European railway systems. In this context, the further development of the European Rail Traffic Management System (ERTMS) supports the single wagonload transport. Such issues are supported by the implementation of European rail freight corridors and the lately defined TEN-T corridors.

3.4.5 Information and communication technologies

Information and Communication Technologies (ICT) have widely been introduced in transport systems in the recent years. Although, especially in single wagonload transport, still not all problems have been tackled, it comes with ICT rather to questions of implementation and not to research and development. Railway operators involved in the ViWaS project assessed ICT as one of their improvement fields in correspondence to SWL transport.

3.4.6 New production schemes

Changing logistics processes in single wagonload transport can lead to cost reductions and/or to higher customer satisfaction. One emerging possibility is the combination of single wagonload transport with combined transport services. Here, free capacities in block trains (shorter than the maximum allowed train length) are used to transport single freight wagons between stations along the route of the train. The issue is further examined in the ViWaS work package 8 "Advanced SWL management procedures and ICT".

3.4.7 Lower entrance barriers for rail technology innovations

Many technical developments have been carried out in railways. However, only few of them have found their way beyond prototyping. Railway systems are regularly faced with entrance barriers for new technologies. This is due to its complexity, the need to modify significant parts of the system in order to get use out of an innovation and thereby high costs of implementation (path dependence).

A well-known example for it is the central buffer coupling. Its implementation would lead to significant cost and time savings at the shunting processes in single wagonload transport11. The implementation regularly failed due to the fact that the central coupling

[11] *Stuhr, H. (2012): Investigation of implementation scenarios of an automatic central buffer coupling. PhD Thesis, Technische Universität Berlin. Chair of Track and Railway Operations.*

requires the entire vehicle fleet to be modified at once. Changes like the central coupling cannot be managed by single railway undertakings and require the control of an authority, favourably combined with an incentive system that lowers entrance barriers of innovative technologies.

4 ViWaS partners' SWL markets and development strategies (company analysis)

The analysis corresponds to the current market situation and developments strategies of the rail freight operators within the ViWaS project, namely Bentheimer Eisenbahn, SBB Cargo and Fret SNCF. The data is compiled on the basis of

- Project-internal exchange of information e.g. in project meetings and telephone conferences etc. and
- A questionnaire distributed to the ViWaS partners in July 2013 containing questions about their current situation in SWL transport (volumes, challenges), planned developments and strategies for SWL services.

The analyses of these data are summarised in the following section.

4.1 Bentheimer Eisenbahn

Bentheimer Eisenbahn (BE) is one of the major regional railway companies in Germany. Main activities are passenger transport, rail freight, road haulage, warehousing and linked logistics services. With an own rail network of about 75 km, BE has a regional focus to Northwest Germany and the neighbouring Netherlands. Partners of BE in rail transport are in particular DB Schenker Rail, but also further private railway companies, which use BE services for last mile collecting and distribution of SWL and block train loads.

About ten private sidings and three rail logistics centres (RLC) are connected to the BE's rail network, namely Nordhorn, Coevorden and Ochtrup-Brechte (planned).

- The RLC in Nordhorn, operated by BE, offers warehouse facilities with both, road and rail connection. The bandwidth of logistics services ranges from direct transhipment between road and rail, buffer and long-time storage to picking and distribution.
- The RLC in Coevorden is a cross-border freight village, partly located in the Netherlands and in Germany, covering an area of 350 hectares. In recent years numerous companies related to transport logistics and distribution of goods have settled within this freight village. In Coevorden, BE also operates a state-of-the art intermodal terminal with a transhipment capacity of 50,000 loading units per year.
- The rail transhipment facilities in Ochtrup-Brechte, owned by the German Ministry of Defence, are currently dedicated for the transhipment of military goods. It is planned to develop this location for public use.

In the ViWaS project, BE promotes the further development of these RLCs and their service profiles. This includes the optimisation of SWL transport, in particular the closer integration of SWL-transport in the supply chains, the concerning transhipment technologies and the pre- and end-haulage on rail and road.

In 2012, BE achieved a total rail freight volume of 1.26 million tonnes. 0.85 million tonnes (67%) have been transported in block trains and 0.31 million tonnes (25%) in intermodal trains. With more than 100,000 tonnes, SWL transport accounts for about 8% of BE's total rail freight transport volume in 2012. With 90%, the lion's share was operated via the RLCs in Nordhorn and Coevorden, whereas 10% of BE's SWL transport volume was operated via sidings. This indicates the high importance of the existing rail logistics centres for the SWL business of Bentheimer Eisenbahn.

Current markets

Regarding commodities, the current structure (in 2012) of BE's rail freight volumes mirrors the economic structure of the regional catchment area in Germany and the Netherlands:

- In SWL transport, the main markets are "Agricultural products and live animals" (50%), "Metal products" (25%), "Fertilisers" (10%) and "Machinery, transport equipment, manufactured products and miscellaneous articles" (5%);
- For block trains, the most important commodities are "Foodstuff and animal fodder" (40%), Solid mineral fuels (20%) and "Crude and manufactures minerals, building materials (20%)";
- In intermodal transport, "Foodstuff and animal fodder" (50%) plays an important role as well as "Agricultural products and live animals" (15%) and "Chemicals" (25%) for the chemical industry in the Netherlands located in Emmen.

Current challenges

Currently the main challenges for BE's SWL transport are:

- Increasing infrastructure costs (e.g. train paths) in particular on international trade lanes - even slight increases in rail costs can cause a customer's decision for the shift of transport volumes from SWL to truck;
- the punctuality and reliability of the SWL transport chain are often not matching the customers' requirements, in particular for quality goods which are often part of JIT and JIS transport chains;
- The reduction and restructuring of SWL production services e.g. in France and Italy and especially the decreasing number of railway access points (e.g. railports and sidings) in Italy hampers the maintenance and development of international SWL offers.

Future markets

For the future SWL market development, BE estimates significant additional transport potentials for "Agricultural products and live animals". These positive expectations are especially related to international southbound trade lanes to France, Italy and Switzerland, provided that appropriate conditions are available on the corresponding destination of the respective transport chain.

Additional volumes are predicted in their "traditional" SWL commodities. Furthermore, clients located in the Netherlands are inquiring for the development of additional SWL services for "Crude and manufactures minerals, building materials" to different destinations in Sweden. Currently, first test shipments to Sweden have been completed successfully. Final negotiations with the shipper and the involved logistics service provider (LSP) have been started (status: October 2013).

Strategies for the improvement of SWL services

Bentheimer Eisenbahn focuses on the following measures for the opening of new markets and the securing of existing SWL transport volumes:

- Further development of rail logistics centres, their services profiles and the optimisation of transhipment processes between road and rail. Rail logistics centres are hubs for the transhipment, intermediate storage, picking and distribution of freight and offer a platform for customers without own rail sidings to enter SWL transport.
- For the optimisation of cost efficiency of last-mile road services, BE is pleading for an implementation of a "44-tonne-regulations" comparable to intermodal transport chains in Germany. For instance, for turf transport currently 2.3 truckloads are needed for road services to the RLC in Nordhorn to fill one rail wagon - instead of two when 44-tonnes would be allowed.
- BE plans to streamline the rail production e.g. by the use of hybrid locomotives for achieving a better efficiency of last-mile rail services. The rail net of BE is non-electrified. Therefore a change of locomotives (electric to diesel units or vice versa) in the interchange station Bad Bentheim is necessary. This causes an increase of transport time and rail production costs.
- BE intends to optimise capacity utilisation of trains in order to lower traction cost per wagon. This shall be done by the reduction of empty wagon runs and the increase of SWL transport volumes.
- The implementation of advanced ICT technologies and telematics systems to provide tracking and tracing opportunities to the customers of SWL transport.
- For long distance, rail transport partnerships with other railway undertakings are aspired in order to (a) bundle transport volumes to gain more efficient train paths and (b) to enable linking in existing transport flows. Furthermore in the field of rail production it is planned (a) to join existing/planned networks (like Xrail) or (b) creating own network with suitable market players (e.g. LSP).
- Moreover, marketing actions will be intensified: intensive communication with customers and a more structured analysis of potential clients.

Future challenges

From BE's point of view, the future main challenges for SWL transport are:

- Raise of cost efficiency in order to offer competitive prices (benchmark is road transport) towards the customers, especially in decentralised regions,

- Increase punctuality and flexibility of SWL rail production;
- Acquire long-term contracts;
- Find the “appropriate” contractors (big customers use block trains, small customers do not use rail transport);
- Achieve a stable and optimised SWL international production network to be able to reach destinations all over Europe.

4.2 SBB Cargo

SBB Cargo is the rail freight subsidiary of the Swiss Federal Railways (SBB). In Switzerland, SBB Cargo is the market leader in rail freight services and the dominating provider of domestic SWL services. SBB Cargo is part of the Xrail alliance for international wagonload services. SWL has a high significance for rail freight transport in Switzerland.

For a future-oriented extension of SWL, SBB Cargo plans to improve the efficiency (operational and economics) by the development of new concepts e.g. for bundling of SWL and maritime intermodal traffic. Within the “Swiss- Split” system, SBB Cargo already offers the delivery of maritime containers to railway sidings. In order to extend availability and to acquire new customers, SBB Cargo and partners will develop, test and demonstrate new production methods, traction schemes and adapted technologies in the so-called ViWaS business case “Swiss Split 2”.

SWL is the backbone of the Swiss rail transport market. In 2012, SBB Cargo had a total rail freight volume of 43.7 million tonnes, of which SWL had the biggest share with 19.7 million tonnes (45%). Intermodal transport had a volume of 13.5 million tonnes (31%) and block trains of 10.5 million tonnes (24%).

Current markets

With respect to commodities in Switzerland, the following picture for 2012 emerges:

- In SWL transport “Paper, wood and part-load traffic”, altogether with 43% are dominating. Also important are “Fertilisers” (11%) and “Crude and manufactured minerals, building materials” with 8%. All other commodities have 5% or less. A share of 13% cannot be assigned;
- Block train transport is dominated by “Petroleum products” (20%) and “Chemicals” (20%). Each of 10% account for “Agricultural products and live animals”, “Foodstuffs and animal fodder”, “Ores and metal waste”, “Metal products”, “Fertilisers” and Paper, wood, part-load traffic”.
- Within intermodal transport most of the goods (90%) could not be assigned except “Petroleum products” and “Chemicals” (each with 5%).

In the single wagonload transport of SBB Cargo, the entire transport volume is operated via private sidings.

Current challenges

Currently the main challenges for SBB's SWL transport are:

- The decreasing number of sidings in Switzerland obviously reduces the group of potential customers. In fact, up to now this development has only a minor effect on SWL transport volumes. The close-down of about 130 served stations and sidings in 2012 had reduced transport volumes only by 2%.
- SBB Cargo indicates that transport time is a strong challenge for the competiveness of SWL compared to road.
- The most important challenge is the reduction of the transport cost. Therefore, in particular rail production has to be optimised in order to increase the competiveness of SWL
- The reliability SWL service in Switzerland is regarded as sufficient. In the last two years, the operational punctuality of domestic trains amounted to over 98%, whereas international trains (block trains and intermodal services) had a punctuality of only 79% in the same time frame.
- Limitations in the short-term availability of wagons in Switzerland partially hamper the execution of SWL transports.
- In international SWL trade lanes, the restructuring and reduction of SWL production systems in the neighbouring countries France and Italy have a strong impact on the development of transport volumes.

Future markets

In general, SBB Cargo estimates stagnating or even declining SWL transport volumes in a medium to long term time frame. Nevertheless, in the next three years in particular, the following markets will significantly increase with 5 to 10% per year:

- Construction site traffic with "Crude and manufactured minerals, building materials";
- Import and export traffic of maritime containers within Swiss Split.

Strategies for the improvement of SWL services

SBB Cargo focuses on the following measures for the opening of new markets and the securing of existing SWL transport volumes:

- In terms of the future development of SWL services on international trade lanes from and to Switzerland, SBB Cargo will rely on the developments and achievements of the Xrail alliance in which the company was a founding member. This includes the rail production on international trade lanes, the joint co-operated marketing and standardised ICT and telematics systems.
- For domestic transport, a stronger promotion and further development of the Swiss split system is of prime importance. With Swiss split, SBB Cargo will participate in the predicted strong growth of the worldwide container traffic and the aspired modal shift to rail in the hinterland traffic of the North Sea ports. In order to improve this transport chain, new technical solutions are currently being

developed within the ViWaS project that allow an improved loading and unloading of the containers on rail wagons in the sidings. Currently, the containers are transported on conventional flat cars. For future operation, two technical designs are considered:

- A modified intermodal wagon which is equipped with a "plugin" floor which allows that the complete wagon is accessible for forklift operation to load or unload containers.
- A conventional intermodal wagons in combination with a new loading platform. This platform shall overcome the different height levels of container, wagon floor and loading ramp to allow secure drive-on by forklift. The platform fits into ISO container length dimensions, is equipped with corner fittings and therefore can be fixed on standard container wagons by the existing pins. To optimise the dispatching within the logistics chain, the platforms shall be equipped with appropriate tracking modules.

- In order to reduce CO_2 emission in last mile rail services, the use of new hybrid locomotives will play an important role.
- For the future optimisation of train operation, automatic brake tests are planned. In a first step, technology is foreseen for shuttle trains with fixed wagon sets
- Furthermore, inland terminals (with modern design and infrastructure) with hub functionalities shall facilitate the extension of additional logistics services.

Future challenges

SBB Cargo sees a number of strong future challenges for SWL transport for the time horizon 2020:

- Further decreasing number of facilities (served stations and private sidings);
- Elimination of regulations in favour of road transport;
- Bottlenecks in the infrastructure capacities of rail infrastructure and terminals;
- Decreasing oil prices (in favour of road transport) and
- Elimination of Swiss state grants for rail services (e.g. funding for private sidings and intermodal terminals).

4.3 Fret SNCF

The ViWaS partner Fret SNCF is part of the SNCF Transport and Logistics Division which, since July 2008, includes Geodis and SNCF Freight Transport and Logistics Partner. Fret SNCF offers transport and logistics services in several European countries. The company had streamlined their SWL network during the last years and aspires further improvements of operation efficiency.

In 2012, Fret SNCF had a total rail freight volume (wagon load, without intermodal) of 55.4 million tonnes. 41.9 million tonnes (77%) have been transported in block trains and 12.5 million tonnes (23%) in single wagonload trains.

Current markets

Regarding commodities, the current structure (2012) of Fret SNCF's SWL freight volumes emerges the following picture:

- The most important commodity are "Metal products" (29%) followed by;
- "Petroleum products" with a share of 26%;
- "Ores and metal waste" with a share of 15%;
- "Chemicals" with a share of 13%;
- "Machinery, transport equipment, manufactured products and miscellaneous articles" with a share of 10%;
- "Crude and manufactures minerals, building materials" with a share of 4% and
- "Fertilisers" with a share of 3%.

Current challenges

Currently, the main challenges for SNCF in SWL transport are:

- Longer transport times compared to the competing road service is assessed as a strong challenge.
- Transport costs have a very high impact on development of transport volumes for SWL services.
- The lack of reliability hampers the customer's acceptance of SWL transport offers in a high degree. This also applies for the mostly inadequate and non-competitive SWL production systems on international level.
- Insufficient short-term availability of wagons in France is strongly influencing the execution of spot-traffic in SWL.
- The provision of siding, namely the costs for maintenance and operation, as well as the rigid regulations for serving (e.g. required shunting staff) have a negative impact on the cost efficiency of SWL transport chain.
- The lack of adequate information systems in SWL is currently evaluated as less important.

Future markets

For the development of the domestic SWL market, SNCF estimates potentials for increasing transport volumes by 2015, in particular for "Chemicals" and "Metal products". Increasing transport volumes in international transport are predicted for the entire SWL market on trade lanes with Belgium and Germany and especially to the North Range ports.

Strategies for the improvement of SWL services

The following measures and strategies were rated by SNCF as important for the improvement of SWL service:

- The efficiency of last mile services on rail has to be significantly improved. This concerns the enhancement of load factor/capacity utilisation of trains as well as the rise of performance of distribution trains serving several private sidings. Within ViWaS, SNCF develops and demonstrates a new concept for last rail mile service. This approach is based on the separation of the movement of distribution trains on secondary lines from the operations of cutting and end-hauling of wagons into the customer' siding. This shall be done by bimodal road-rail vehicles.
- Concerning IT technologies, SNCF sees the need for a bundle of improvements and measures: data exchange and data access shall be optimised by standardisation, real-time information and the harmonisation of interfaces in order to facilitate information supply for every relevant participant of the SWL transport chain.
- For the combination of SWL and intermodal rail freight services, it should be ensured that potential customers have only one central contact point on operators' sides for both SWL and intermodal service.
- For the long distance rail transport, also load factors have to be improved in order to raise cost efficiency of train operations.
- In terms of co-operation in rail production on the national market, the sharing of common resources with other relevant market players, especially for sidings, should be included. In the international market, rail production shall be optimised by co-operating with small contractors. End-to-end contracts shall serve as marketing arguments and in respect of linking SWL and intermodal services, there shall be a closer cooperation in serving global port areas (e.g. North Range Ports).

Future challenges

SNCF estimates the following to be the most important future challenges for SWL for the time horizon 2020:

- lack of adequate international SWL production systems;
- problems in real-time tracking and tracing at an international scale and
- insufficient investments in necessary facilities (e.g. shunting yards).

5 Success criteria

5.1 Key performance indicators (KPIs) in SWL transport

Generally, key performance indicators (KPIs) are a common tool to assess the success of a project or a business activity. They are applied to facilitate the understanding of strengths and monitoring of progresses and effects, as well as assisting active counteractions against unwanted developments. Therefore KPIs should be based on quantifiable data that provide a method for measuring the impact of e.g. technological and organisational developments. This applies for measures and developments in SWL transport in particular because the sophisticated and complex transport chain involving different stakeholders with specific goals.

Potential measures to improve SWL are for example (listing is not exhaustive):

- Commercial actions, targeting a good load factor of the trunk trains and of the collection/delivery trains,
- An improved and automated marshalling system (e.g. by tagged waggons equipped with remote controlled automatic; remote controlled shunting locomotives; automatic track brakes controlling the waggons movements to give them the adequate speed just to re-couple with the other waggons) allowing a quick departure; telematics systems with information about waggon information and status for the automation of planning and dispatching processes.
- Improved train length and driving dynamics due to waggons equipped with electronic brakes, which enables a freight train to brake and release the brakes for all waggons at the same time and without any reaction delay; thereby reaching a higher capacity and reduced transport times, especially due to the allocation of better train paths.
- Improved reliability and predictability due to monitoring systems capable to provide the different stakeholders (e.g. railway operators, infrastructure operators, shippers) with adequate information about the real-time ETA (Estimated Time of Arrival) in combination with pre-information about the route of the waggons.
- The collection and delivery of waggons operated with optimised 'last mile' production methods aiming at considerable reductions of the production costs.

The following two tables contain a summary of identified KPIs (listing is not exhaustive) for the assessment of measures and developments in SWL transport assigned to operational KPIs (Figure 33) and infrastructural KPIs (Figure 34). For each of these KPIs, the relevant units of measurement and an adequate method for their capture has to be defined.

Figure 33: Potential operational KPIs in SWL transport

	criteria	KPI	description
Operational KPIs	**cost efficiency**	train utilisation rate	increase of utilisation cost reduction
		transport volumes	increase of utilisation cost reduction
		last mile operation	increase of utilisation cost reduction
		telematics operation	reduce of operation costs
	service quality	transport time	reduce of run-times sender to consignee
		reliability	increase of on-time deliveries
		frequency	increase of trains per period
		last mile operation	increase of frequency lower run-time
		information flows	increase of data availability and data quality
	environment	CO_2 emissions	reduce of emissions (long haul, last mile)

Source: HaCon

Figure 34: Potential infrastructural KPIs in SWL transport

	criteria	KPI	description
Infrastructural KPIs	**cost efficiency**	investment costs	reduce of investment costs
		maintenance cost	reduce of maintenance costs
		transhipment costs	reduce of transhipment cost
	capacity	usage of space	increase of utilisation
		throughput	increase of volumes per unit of time

Source: HaCon

The final selection of appropriate KPIs should be to be done according to the SMART approach; this means:

(1) The KPI must be related to a **S**pecific goal;

(2) the KPI must be **M**easurable to really get a value;

(3) the KPI goals must be realistic and **A**chievable;

(4) the improvement of a KPI has to be **R**elevant to the success of the project activity and

(5) KPI goals should be related to a relevant **T**ime period.

The concrete selection of relevant KPIs for the ViWaS business cases will be carried out based on the KPIs and the above described methodology.

5.2 KPIs of the ViWaS business cases

Taking into account the specific requirements of the business cases and the methodology described in chapter 3, individual sets of key performance indicators have been identified in a first step. This exercise was carried out by the respective project partners considering the specific goals of each business case. The results are summarised in Figure 35 to Figure 39 on the following pages.

Business case "Swiss Split 2"

With Swiss Split, SBB Cargo will participate in the predicted strong growth of the worldwide container traffic and the aspired modal shift to rail in the hinterland traffic of the North Sea ports. In order to improve this transport chain, technical improvements and solutions are being developed that allow an improved loading and unloading of the containers on rail wagons in the sidings. Two technical designs will be developed and tested: (1) A modified intermodal wagon equipped with a "plugin" floor and (2) a conventional intermodal wagon in combination with a new loading platform.

Additionally SBB Cargo will develop new traction concepts for low-distance train operation between terminals and sidings by deploying a small hybrid locomotive.

Figure 35: Selection of operational KPIs for Business case "Swiss Split 2"

	criteria	KPI		description	unit of measurement
Operational KPIs	**cost efficiency**	1	transport volumes	no. of containers in Swiss Split	loading unit per days
		2	operation hybrid locomotive	decrease in locomotive use	no. of rolling stock
	service quality	3	customer acceptance	increased customer acceptance and satisfaction	survey, customer acceptance and satisfaction (basis: 50 customers)
	environment	5	CO_2 reduction hybrid locomotive	reduction of diesel by use of environmental friendly produced electricity	operative hours of diesel locomotive

Source: HaCon based on SBB Cargo

Business case "Regional network of rail logistics centres"

Bentheimer Eisenbahn AG will further develop their network of rail logistics centres in north-western region of Germany. The focus will be on improved last mile operations, the streamlining transhipment in the rail logistics centres, the extension of logistics service profile and the test of hybrid traction.

Figure 36: Selection of operational KPIs for Business case "Regional network of rail logistics centres"

	criteria	KPI		description	unit of measurement
Operational KPIs	**cost efficiency**	1	transport volumes	no. of wagons	wagons per week
		2	transport volumes	no. of wagons	wagons per delivery train
		3	transhipment	share of direct transhipments	share on total per week
	service quality	4	frequency	no. of delivery trains	trains per week
		5	time benefit	use of hybrid loco	minutes per delivery haul
	environment	6	CO_2 emissions	modal shift road to rail	tonnes per month

Source: HaCon based on Bentheimer Eisenbahn

Figure 37: Selection of infrastructural KPIs for Business case "Regional network of rail logistics centres"

	criteria	KPI		description	unit of measurement
Infrastructural KPIs	**capacity**	1	throughput	increase of SWL freight in RLC	tonnes per week

Source: HaCon based on Bentheimer Eisenbahn

Business case "Last mile service on French secondary lines"

The last mile operation method proposed in ViWaS is based on the separation of the movement of the distribution train on the secondary line from the operation of cutting the required number of wagons from the distribution train, couple them to a bimodal small hauling truck and drag them to the private siding. During the cutting of the wagons, the distribution train is stopped on track. As soon as the wagons are decoupled, the distribution train goes to its next delivering point. The bimodal truck equipped with tyres and rail axels hauls the wagons to the private siding and re-joins the distribution train by road. The cost reduction and the capacity increase may allow serving certain new areas with scattered traffics at acceptable costs.

Thus, the following KPIs have been selected:

1. Investment costs on the private siding for the delivery of less than ten wagons. The KPI will be the basic investment cost.
2. Operational costs of a delivery of a given number of sidings served today by one distribution train. The KPI will be the delivery cost per siding.
3. The percentage of time gained on one round trip of the train (giving an idea of the reserve of capacity to possibly serve a larger area).

Because of this methodology, the advantages are the following:

- Simplify the private siding's plan as it needs one track and one switch less than with a pure rail locomotive which significantly reduces the investment cost.
- The number of staff necessary to operate the distribution is also reduced as there is no backward push of the train.
- The bimodal hauling machine may be shared by several users.
- The delivery capacity of the line is increased as the operations are simplified which enables the distribution train to serve more customers.

Figure 38: Selection of operational KPIs for Business case "Last mile service on French secondary lines"

	criteria	KPI		description	unit of measurement
Operational KPIs	**cost efficiency**	1	infrastructure costs	costs for investment and maintenance	costs per siding (€/m)
		2	operational costs	delivery of a given number of wagons	costs per delivery
	service quality	3	time benefit	time gained per roundtrip of train	hours per delivery haul

Source: HaCon based on NEWOPERA / Fret SNCF

Business case "SWL-based special waste transport chains"

The transport of hazardous waste from a landfill remediation in Switzerland to different waste treatment sites spread across Germany and Belgium by rail is very challenging. Due to fluctuations in the remediation progress, the range of destinations, limited on-site buffer capacities and limited track lengths block train operation is not possible and SWL needs to be applied. Because the disposal facilities require just-in-time delivery and authorities and/or customers often request a continuous monitoring project, ViWaS will enhance telematics for hazardous waste transport by SWL.

One of the major aims within the ViWaS project is a significant cost reduction of wagon-based telematics systems to make this alternative information source attractive and profitable for SWL operators as wee as waggon keepers/ECMs. Such a new telematics development will also include the implementation and use of the European Galileo positioning services.

Figure 39: Selection of operational KPIs for Business case "SWL-based special waste transport chains"

	criteria	KPI		description	unit of measurement
Operational KPIs	**cost efficiency**	1	telematics costs (hardware)	costs of new telematics systems	cost reduction [%]
		2	telematics costs (installation)	costs for installation	cost reduction [%]
	service quality	3	information quantity	data transmission frequency at a defined battery life	increase of transmission frequency [%]
		4		no. of diff. information types	increase of information types
		5	information quality	higher position availability	increase of percentage of position availability
		6	information flexibility	no. of possible information receivers	increase of no. of receivers
		7		no. of possible data formats and channels	increase of no. of data formats and channels

Source: HaCon based on Eureka

Reference values for the validation of effects will be derived from CREAM project in which telematics systems had development had been developed and evaluated.

For the exercise on the KPIs within the next work steps, the following tasks have to be performed for each business case:

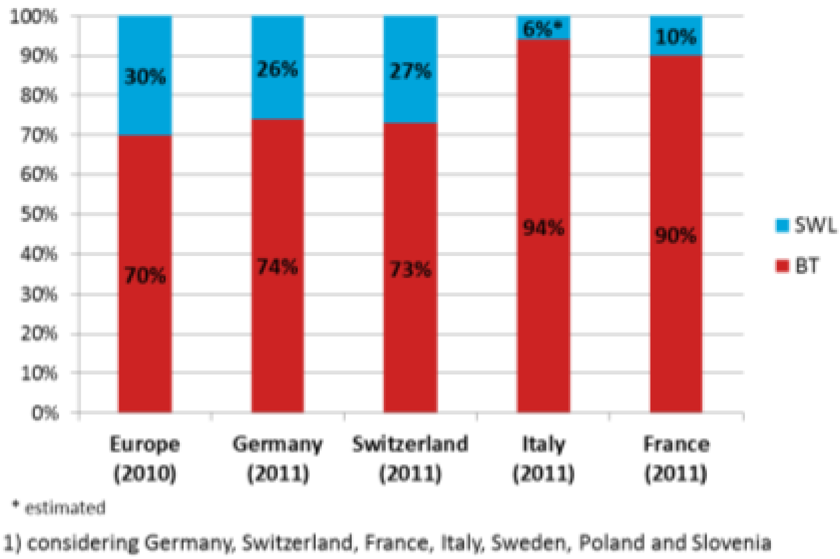
- definition of status-quo or initial situation to which the measured effects will be compared;
- final agreement on units of measurement and relevant time periods;
- definition of a methodology to capture the KPI-relevant data.

6 Conclusions

The analysis of the overall development of the rail freight market in Europe and in particular in the ViWaS partner countries focussed on SWL business have shown the following main results:

(1) SWL is still a major component in numerous European states' rail transport systems. This applies in particular for Germany and Switzerland. In Italy (in 2009) and France (in 2010), the "classic" production systems have been abandoned due to economic reasons. This led to significant losses of SWL transport volumes in these countries.

Figure 40: Market shares of SWL on total rail freight volumes based on tonne kilometres

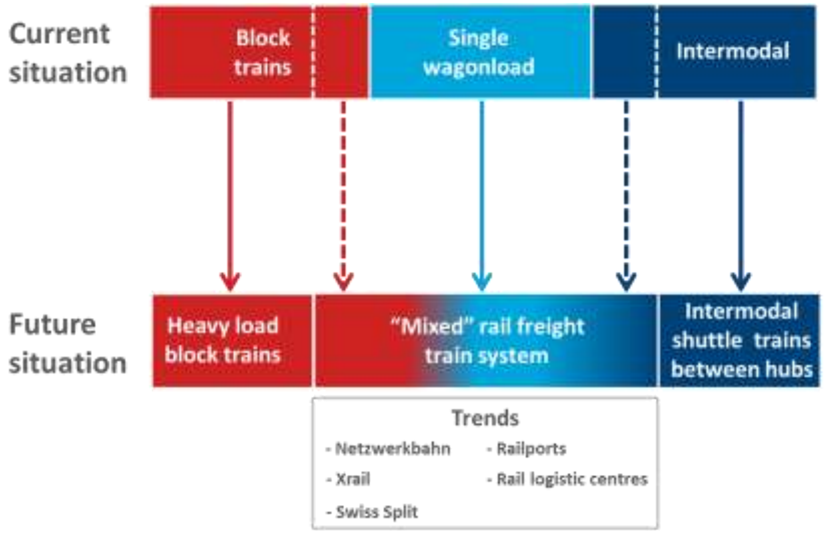


(2) Specific industries and market segments (e.g. chemical industry, steel industry, automotive industry) still demand rail freight services below the block train segment (single wagons, wagon groups) for domestic and international transports. Due to the hard competition to road transport, SWL operation has to be optimised with respect to cost efficiency and transport quality.

(3) The existing and future market demand for SWL services has been realised by (many) European railway operators. Especially in France and - partly - in Italy, RUs are entering the market with new offers based on alternative production systems and improved quality standards supported by ICT / telematics systems. The formation of the Xrail alliance is exemplary for the trend to improve quality and transport performance.

(4) Existing "borderlines" between the "classic" rail production systems will be narrowed in order to raise capacity utilisation and competiveness of the entire rail freight system. Netzwerkbahn in Germany and Swiss Split in Switzerland are examples for the trend towards mixed rail freight production forms.

Figure 41: Rail production systems and trends



(5) An important success factor for SWL is the improvement of last mile services and the provision of transhipment nodes for customers which do not have own access point. The use of hybrid technology for the propulsion of locomotives and bi-modal shunting vehicles can enhance operation processes within the last mile. The implementation of railports and rail logistics centres will support the access to SWL services for a bigger group of potential clients. At the same time such rail logistics nodes facilitate an efficient "feeding" of SWL and the future "mixed" rail freight system (securing the critical mass).

(6) The analyses and findings, documented in this report, show that the planned ViWaS developments correspond to the most urgent challenges and market needs. The aimed at solutions are therefore considered as important components in the evolution process to future rail freight systems that are able to compete in a more and more challenging transport market. In detail the ViWaS developments tackle the following action fields (work packages):

- Market driven business models and production systems, considering opportunities for bundling different types of traffic to secure the critical mass needed for SWL operations;
- New ways for 'last mile' operational methods;
- Adapted SWL technologies to improve flexibility and equipment utilisation;
- Advanced SWL management procedures & ICT to raise quality, reliability and cost efficiency.

(7) The ViWaS developments are done on the basis of real business cases. The success of the aimed at improvements is measured on the basis of a set of KPIs for each business case.

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