

## Project Final Report

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## Table of Abbreviations

|                 |  |
|-----------------|--|
| CEO             | Chief Executive Officer  |
| cp.             | Compare  |
| CO <sub>2</sub> | Carbon dioxide   |
| DG Move         | Directorate-General for Mobility and Transport   |
| Fig.            | Figure   |
| ft              | Foot or feet   |
| FTL             | Full train load  |
| GPS             | Global Positioning System  |
| GSM             | Global System for Mobile Communications  |
| IBC             | Intermediate bulk containers (IBC)   |
| ICT             | Information and Communication Technologies   |
| LSP             | Logistics Service Provider   |
| MATSim          | Multi-Agent Transport Simulation Toolkit   |
| Mio.            | Million  |
| RLC             | Rail Logistics Centre  |
| RU              | Railway Undertaking  |
| SWL             | Single wagonload transport   |
| t               | Tonne  |
| TCCU            | Telematics data distribution service   |
| VDV             | Association of German Transport Companies (Verband Deutscher Verkehrsunternehmen)  |
| ViWaS           | Viable Wagonload Production Schemes  |
| WagonSim        | Wagon Transport Simulation Toolkit   |
| WP              | Work package   |
| Xrail           | Alliance of six European freight railways (CFL Cargo, , DB Schenker Rail, Green Cargo, Rail Cargo Group, SBB Cargo and SNCB Logistics) |

# 1 Final publishable summary

## 1.1 Executive summary

Rail transports of single wagons or wagon groups are an indispensable part of the transport chain, such as for the forestry and the chemical industry. However, high production costs and low quality standards have led to a continuous decline in market shares in recent years. In order to counteract this tendency, ten European companies and research institutions, covering the areas of rail transport and logistics, have combined their forces in the scope of the research and development project ViWaS (Viable Wagonload Production Schemes). The goal: Innovative and simultaneously practical solutions for a sustainable wagonload transport. The applicability of these solutions and their effects has been proven with the aid of business cases in terms of field tests and pilot operations. The following main innovations have been achieved within the ViWaS project:

(1) Improved 'last-mile' operating concepts incorporating hybrid locomotives and bi-modal shunting engines (by Bentheimer Eisenbahn, Fret SNCF and SBB Cargo supported by HaCon and NEWOPERA): The new production method for 'last-mile' delivery is based on the idea of separating train movements and sidings shunting processes by deploying bimodal road/rail tractors. Processes within the sidings have been simplified; as a result costs for equipment and staff could be reduced considerably. Hybrid locomotives are fundamental in securing a seamless access to regional distribution rail networks. Potential cost advantages have been identified comparing different traction combinations of real-life transport chains.

(2) Modular wagon technologies for a flexible and efficient use of resources (by Wascosa and SBB Cargo): In detail, three components have been developed up to prototype status: Wascosa's Flex Freight Car is a light container wagon with an accessible floor and thereby applicable for various transport purposes. The Timber Cassette 2.0 is a new superstructure for log wood transport that features foldable stanchions and can be used in combination with a container wagon. In case the Timber Cassette is not loaded, it can be removed and stacked at the terminal or on a container wagon. Empty runs will be minimised generating efficiency improvements. Additionally, SBB Cargo has developed the so-called Container Loading Adapter, another add-on to a container wagon. It facilitates container loading and unloading in sidings. SBB Cargo will deploy this new component within the "Swiss Split" production system, combining intermodal with wagonload transport.

(3) Smart wagon telematics allowing improved tracking at reduced costs (by Eureka): Innovative telematics and ICT services seek to improve operation performance and on-time delivery by introducing telematics devices together with a telematics data distribution service (TCCU). These devices are managed and controlled remotely by the TCCU and provide real-time information to the different actors involved in the transport chain according to their specific needs. This includes position information as well as different kinds of sensor data like speed, shocks, temperature, loading status and wear related data like wheelset mileage.

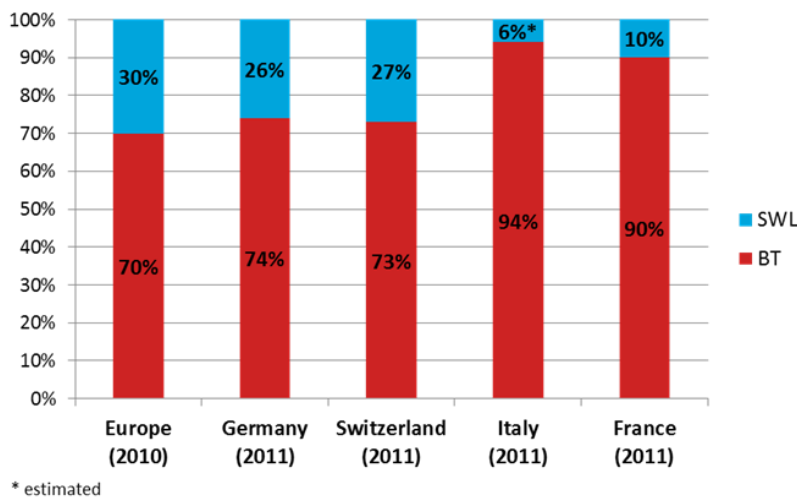
(4) A new simulation tool for planning and optimising single wagonload networks (by ETH Zürich): WagonSIM is an agent-based simulation tool for rail freight networks to facilitate the optimisation of SWL production schemes. It is based on the open source software MatSIM. The tool models the routing of freight wagons according to the routes within the real SWL network. Therefore, the modelling of two network levels is required, the production network and the physical infrastructure.

The ViWaS project is co-financed by the European Commission in the scope of the Seventh Framework Programme.

## 1.2 Summary of project context and objectives

In Europe today, the general framework of rail freight transport is exposed to significant changes. This is especially true for rail transports of single wagons or wagon groups. In 2005, single wagonload (SWL) transport accounted for 39 % of Europe's rail freight transport performance, but only five years later this number dropped significantly to only 30 %. Nevertheless, SWL is still a major component in numerous European states' rail transport systems. This applies in particular to Germany and Switzerland. In Italy (in 2009) and France (in 2010), the "classic" rail production systems have been abandoned due to economic reasons. This led to significant losses of SWL transport volumes in these countries (cp. Figure 1).

**Figure 1: Market shares of SWL on total freight volumes based on tonne-kilometres**



*Source: ViWaS; figures for Europe are based on data for Germany, Switzerland, France, Italy, Sweden, Poland and Slovenia*

With a near to non-existent level of competition within the SWL market itself, low-quality standards and unfavourable cost structures have become widespread. While it may be lacking in internal competitiveness, it faces strong competition from conventional block trains, intermodal transport and road transport services.

Despite the current situation of SWL transport, it still provides a vital service to industries wanting to shift freight below the block train segment level such as forestry and the chemical industry. In a bid to halt its deterioration, the 39-month Viable Wagonload Production Schemes (ViWaS) project has undertaken to breathe new life into the SWL market through improvements in cost efficiency, transport quality and sustainability. Ten European companies and research institutions from the areas of rail transport and logistics have joined forces in the frame of the Seventh Framework Programme (FP7) of the European Commission. The aim was to further develop SWL technologies and concepts, tested and proven on the basis of real business cases and in line with the market requirements.

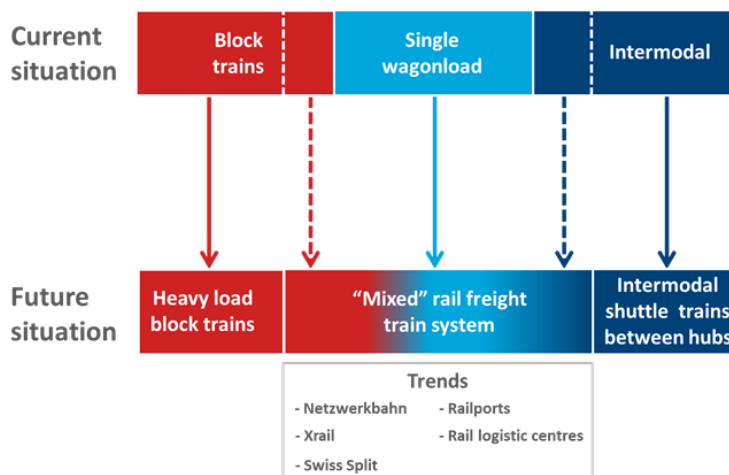
The developments are based on an initial analysis of the overall rail freight framework conditions, markets and trends in Europe and in particular in the ViWaS partner countries, focussing on SWL business. Following main conclusions have been drawn from the analysis:

- (1) Specific industries and market segments (e.g. forestry, 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.

- (2) The existing and future market demand for SWL services has been realised by (many) European railway operators. Especially in France and - partly - in Italy, new railway operators are entering the market with 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.
- (3) Existing "borderlines" between the "classic" rail production systems will be narrowed in order to raise capacity utilisation and competitiveness 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 (cp. Figure 2).

**Figure 2: Rail production systems and trends**



Source: ViWaS

- (4) An important success factor for SWL is the improvement of last mile services and the provision of transshipment nodes for customers which do not have own access points. 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 of freight volumes).
- (5) The findings from this initial analysis showed that the 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.
- (6) 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.

The ViWaS developments concern innovative and simultaneously practical solutions for a sustainable wagonload transport. The applicability of these solutions and their effects has been proven with the aid of business cases in terms of field tests and pilot operations. The following main innovations have been achieved within the ViWaS project:

**Improved 'last-mile' operating concepts** incorporating hybrid locomotives and bi-modal shunting engines (by Bentheimer Eisenbahn, Fret SNCF and SBB Cargo supported by HaCon and NEWOPERA): The new production method for 'last-mile' delivery is based on the idea of separating train movements and sidings shunting processes by deploying bimodal road/rail tractors. Processes within the sidings have been simplified; as a result costs for equipment and staff could be reduced considerably. Hybrid locomotives are fundamental in securing a seamless access to regional distribution rail networks. Potential cost advantages have been identified comparing different traction combinations of real-life transport chains.

**Modular wagon technologies** for a flexible and efficient use of resources (by Wascosa and SBB Cargo): In detail, three components have been developed up to prototype status, namely the Flex Freight Car, Timber Cassette 2.0 and the Container Loading Adapter.

Wascosa's Flex Freight Car is a light container wagon with an accessible floor and thereby applicable for various transport purposes.

**Figure 3: Wagon equipment for container loading and unloading in sidings**



*Container Loading Adapter (left picture) and Flex Freight Car with iron grid inlay (right).*

*Source: SBB Cargo*

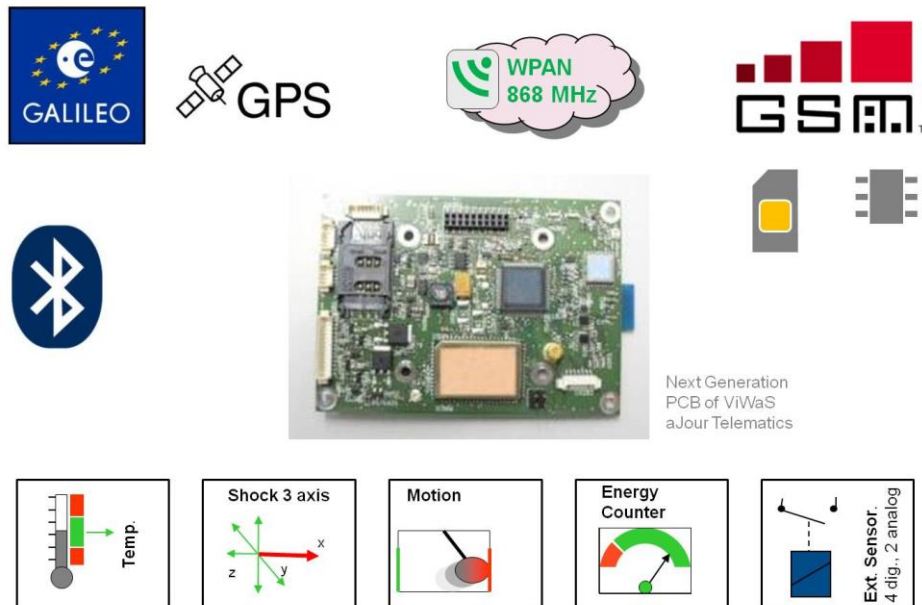
The Timber Cassette 2.0 is a new superstructure for log wood transport that features foldable stanchions and can be used in combination with a container wagon. In case the Timber Cassette is not loaded, it can be removed and stacked at the terminal or on a container wagon. Empty runs will be minimised generating efficiency improvements. Additionally, SBB Cargo has developed the so-called Container Loading Adapter, another add-on to a container wagon. It facilitates container loading and unloading in sidings. SBB Cargo will deploy this new component within the "Swiss Split" production system, combining intermodal with wagonload transport.

**Smart wagon telematics** allowing improved tracking at reduced costs (by Eureka): Innovative telematics and ICT services seek to improve operation performance and on-



time delivery by introducing telematics devices together with a telematics data distribution service (TCCU). These devices are managed and controlled remotely by the TCCU and provide real-time information to the different actors involved in the transport chain according to their specific needs. This includes position information as well as different kinds of sensor data like speed, shocks, temperature, loading status and wear related data like wheelset mileage.

**Figure 4: Functionality of new ViWaS telematics**



Source: Eureka

**A new simulation tool for planning and optimising single wagonload networks** (by ETH Zürich): WagonSIM is an agent-based simulation tool for rail freight networks to facilitate the optimisation of SWL production schemes. It is based on the open source software MatSIM. The tool models the routing of freight wagons according to the routes within the real SWL network. Therefore, the modelling of two network levels is required, the production network and the physical infrastructure.

### 1.3 Main S&T results and foregrounds

This chapter describes the ViWaS main S&T results and foregrounds that are related to one of the following four areas of innovation:

- Improved 'last-mile' operating concepts;
- Modular wagon technologies;
- Smart wagon telematics;
- SWL simulation.

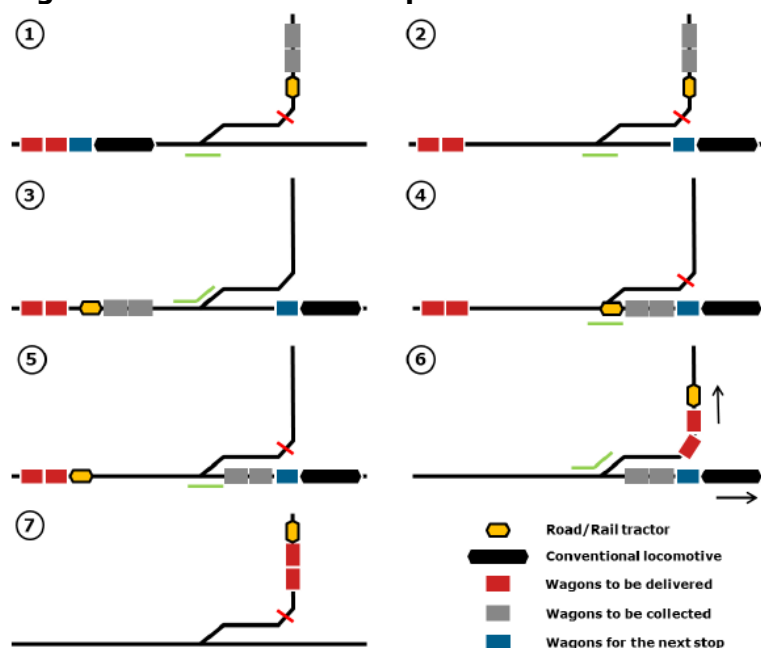
#### Improved 'last-mile' operating concepts

'Last-mile' operations are considered as an important cost driver in SWL rail transports. Process costs for local haulage, transshipment and shunting can easily amount to more than 50% of the overall transport costs, depending on the specific situation and transport distance. Therefore, an important success factor for SWL is the improvement of "last mile" services and the development of handling facilities for customers without own rail access. Capable rail infrastructure as well as efficient transport organisation together with new technologies like hybrid locomotives and bi-modal shunting engines can enhance operation processes for the "last mile".

#### 'Last-mile' operation method

Generally, "last-mile" rail operations for the delivery and collection of rail wagons require a team of two people and a diesel locomotive that are mobilised from the concentration point (= marshalling yard) until the delivery point. These operations include (1) the train run on the main tracks of the National Railway Network, (2) the train run on the secondary line to reach the entrance(s) of the private siding(s) and (3) the delivery of wagons to the private siding by a backing movement, if necessary. The wagon movements inside the siding as well as cargo transshipment are organised by the siding operator himself. All related "last-mile" processes together generally account for some 40-50% of the overall SWL transport costs.

**Figure 5: Take and leave operations with direct entrance**



Source: ViWaS

To reduce this share in costs, Fret SNCF with the support of NEWOPERA have assessed possible improvements by a new “last-mile” operation method that is based on the idea of separating train movements and shunting actions. For this purpose, bi-modal road/rail tractors were deployed to enable wagon delivery/collection and shunting operations independently from the line locomotive. Three areas have been identified that may benefit from the new method: (1) Time savings for the line locomotive can be used to serve additional sidings per work period; (2) The road/rail tractor may be shared between two or three private sidings’ owners in the vicinity and enable reduced investment and maintenance costs and (3) the capability of the shunting tractor to run on road and rail tracks enables a simplified and cheaper track configuration.

**Figure 6: Road/rail tractor MOL 2444**



Source: Fret SNCF

How does the new operation method work? Operational schemes are numerous according to the commercial need (take and leave wagons) to link the private siding and the main distribution line that may be single or double track, classified as main or secondary line. Variations refer also to the exact location of the siding’s entrance and the signalling system in place. Within the project two process chains have been looked at in more detail: one with direct entrance in the private siding (cp. Figure 5) the other with a reverse entrance. In each case the operation scheme is that the RU distribution train stops in front of each siding but does not shunt wagons, whereas the shipper’s road-rail shunting vehicle detaches the loaded wagons from the train that is stopped on the line, and attaches the empty ones (or vice versa).

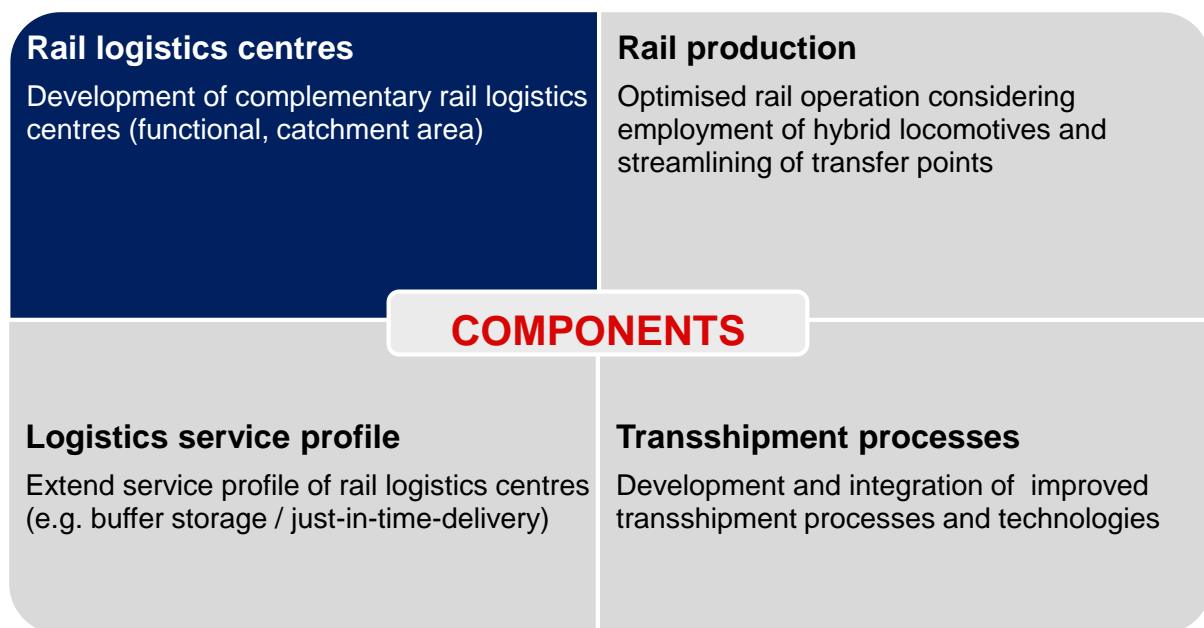
The driver of the RU train helps the bimodal vehicle driver to shunt (coupling, decoupling, switch...). When the shipper’s delivery is complete, the RU train moves towards the next siding by rail and the bimodal moves by road. The theoretical economic analysis took into account the various elements impacting the efficiency: distance on which the distribution train is doing backing movements, the frequency of deliveries, the volume of traffic, the layout of the private siding and the nature of the logistics operations on the private siding as well as the existence of other sidings for a joint use of the road/rail tractor. Of course, the use of the road/rail tractor reduces the number of tracks, necessary switches and their maintenance. It has to be noted that, for existing sidings only, the maintenance savings have to be taken into account while investment savings should also be considered for new sidings.

However, taking into account the main possibilities, a methodology of analysis has been proposed to see where the solution could be effective. It appears that if the authorisation to go out for a simple exchange of wagons on the National Railway Network is granted and if the use with one hand of the remote control is done the global economies (for the distribution train service and the private siding operation) could be at the level of 10% for a single delivery, to 22% for a double delivery. Regarding the French application case, the economic analysis shows an increased efficiency in the inside operations leading to overall economies of 35%. After the positive cost-benefit evaluation, a trial in real-life conditions proofed the capabilities and advantages of the new method and the bi-modal shunting engines.

#### Regional network of rail logistics centres

Whereas the number of small rail sidings is continuously decreasing it becomes more and more important to develop capable rail freight bundling points that also serve rail freight customers without own rail siding. ViWaS partner and German regional railway operator Bentheimer Eisenbahn supported by HaCon has taken up this challenge with the further development of the "Railport" concept. The envisaged network of multifunctional rail logistics centres (RLC) facilitates the transshipment of a wide range of products (e.g. palletized, oversized and heavy goods, liquid and bulk goods, containerized goods). Additionally, the centres provide for further logistics services such as warehousing, pre- and end-haulage by truck or commissioning of goods.

**Figure 7: Complementary rail logistics centres – improvement components**



Source: ViWaS

The main improvement idea within ViWaS is to develop several rail logistics centres in close neighbourhood to each other so to enlarge the number of potential rail freight customers that can be reached in a distance of max 20-30 km from a rail logistics centre and to bundle rail volumes from the different locations. As illustrated in Figure 7 complementary improvement components are related to three areas:

Efficient rail production schemes for long haul and "last mile" transport. In order to optimise the "last mile" by rail, the use of hybrid locomotives has been evaluated. Bentheimer Eisenbahn compared different transport chains to find out the best traction configurations. The calculations show that the TRAXX F140 AC with 'last-mile'

functionality has a great cost advantage on mainly or fully electrified railway relations. In view of the specific framework conditions at Bentheimer Eisenbahn like route profile and speed limits, the 'last-mile' locomotive shows the best efficiency in comparison with other traction configurations, analysed.

Extended logistics service profiles of rail logistics centres widen the range of potential customers. A very important issue is the introduction of SWL services into just-in-time or just-in-sequence supply chains. Bentheimer Eisenbahn developed corresponding logistics concepts for three product groups: (1) steel panels, (2) intermediate bulk containers (IBC) and (3) big bags with salt products.

The previously listed logistics chains have been also used to improve transshipment processes and technologies within the rail logistics centre. Optimisation options include a better organisation of road-rail transshipment sequences (e.g. increasing share of direct transshipment between road and rail) or introduction of improved transshipment technologies (like fork lift trucks with high load capacity allowing "twin lifts"). Within ViWaS, Bentheimer Eisenbahn developed a methodology to analyse and optimise related transshipment processes and technologies and derive decisions for necessary improvement actions: Notably a purchase decision was taken for a more forklift truck with higher productivity (higher payload), storage areas have been re-organised and extended. Additionally, Bentheimer Eisenbahn has introduced a concept that allows the flexible and multifunctional deployment of staff, originally only involved in handling processes. With a special training a dedicated team achieved the permission to perform shunting operations and thereby put another development idea into practice to make operations more flexible, free waiting times and increase productivity, which finally led to the possibility of increasing the frequency of services.

Altogether, the developments can serve as a blueprint for bundling points of conventional rail freight transport that need to be developed in a wide range to enable the viability of less-than trainload services in the long-term.

### **Modular wagon technologies**

The increase of flexibility and the utilisation rate was the top-priority for the development of the three modular wagon technologies:

- Wascosa Flex Freight Car
- Timber Cassette 2.0
- Container Loading Adapter (deployed in Swiss Split 2)

#### Flex Freight Car

For container transports to customers' sidings SBB Cargo has been looking for a new cargo wagon. The Ks-wagon, a two axle wooden floor wagon currently in use, was originally determined to transport bulky goods, such as vehicles, spare parts for bigger machines or other goods that are less sensitive to environmental influences. Today, SBB Cargo also uses these types of wagons to deliver sea containers from gateway terminals in Switzerland to customers' sidings. Although the wagons' dimensions suit the sidings platforms perfectly, there are some disadvantages. Due to the fact that the Ks wagons are not equipped with receptive points for containers, these have to be secured manually by nailing wooden blocks into the floor on each side of the container. Over the years the floors get weakened, thus maintenance costs are high.

Together with Wascosa and ETH Zurich, a solution for a new type of wagon that meets the requirements for loading and unloading containers in sidings was developed. The wagon called 'Flex Freight Car' is based on a classic container wagon (code Sgnss).



Compared to standard KS wagons the wagons' floor is filled in with iron grids. The grid is modular which means that it is possible to remove the different parts of the grid as they are not permanently connected to the chassis. This results in a higher flexibility of the wagon usability: The wagon can be used as a classic container wagon for terminal-terminal transports where no floor is needed or - after a few modifications - it can be used to distribute sea containers into sidings. To test the wagon under realistic conditions SBB Cargo deployed the wagon in defined sidings. Therefore, it has been integrated into the SBB Cargo wagon pool.

**Figure 8: Wascosa 'Flex Freight Car' with iron grid inlays**



Source: Wascosa

#### Timber Cassette 2.0

Conventional rail transports are generally operated with special wagons for specific types of cargo. Transport flows are often done in one direction only. Consequently, the share of empty wagon transports is comparably high and reduces its cost efficiency. Wascosa has therefore developed the flex freight system® to enable a multi-functional usage of container wagons. The system is based on two elements: a light 60ft container wagon and removable swap bodies for a wide variety of cargo.

In 2010, Wascosa has presented the first flex freight unit for timber transports which is a major market for SWL services. The main disadvantage of the already existing timber cassettes was the fact that they had to be transported back empty for reloading, claiming the whole rail wagon capacity. To reach improved capacity utilisation, a new timber cassette was designed and prototypes were constructed in the frame of the ViWaS project. This advanced cassette - so-called "the Timber Cassette 2.0" (Figure 9) - is stackable (up to 6 empty cassettes) for empty runs in order to provide more loading capacity for container transport on the standard rail container wagon. Moreover, it has a reduced height of 2.5 m - compared to 2.8 m of the previous version - and is therefore applicable for transport on trucks as it fully complies with the limits of maximum allowed overall height of 4m for road transport in Europe. The cassettes are used in domestic transports in Switzerland to gather first operational experiences. Afterwards, it is planned to increase the number of units and to extend the operations to international transports.

**Figure 9: Timber Cassette 2.0**



Source: Wascosa

#### Container Loading Adapter

As an alternative to the Flex Freight Car with grid inlays, SBB Cargo developed a 60ft platform: The so-called "Container Loading Adapter" consists of three separate 20ft modules, which together can be put on every standard Sgns or Sgnss container wagon. This platform guarantees also a stable surface to load and unload the containers with forklifts, as shown in Figure 10.

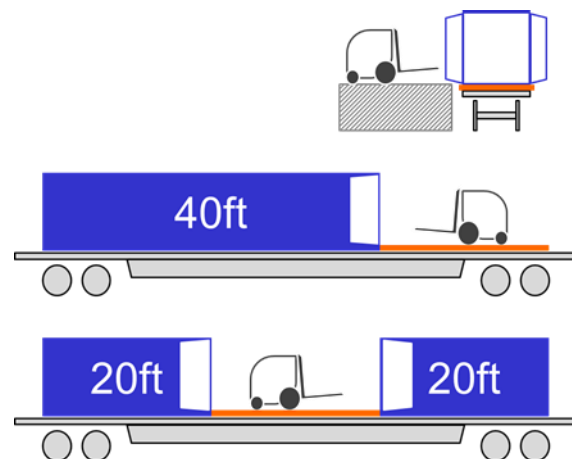
In comparison to the Flex Freight Car, the design of the platform offers some advantages in terms of width and height. To increase usability the platform was designed with the standard floor dimensions of a 20-foot container. The platform is mounted on the wagon in the import/export terminal together with the SWL container. In addition to securing the SWL container to the wagon, the platform helps overcome the difference in height between ramp and wagon as well as ramp and container at the end of the customer's siding. This means that customers do not need to invest in costly ramp reconstructions. The platform guarantees a totally flat, passable surface on the wagon and is mountable on standard Sgns-container wagons.

Although the platform is heavier than the grid inlays, it does not compromise the wagons' payload capacity. Normally, payload in the Swiss Split never reaches its limits due to the fact that of 60ft only 45ft can be used for loading.

**Figure 10: Container Loading Adapter**



Source: SBB Cargo



The Container Loading Adapter as well as the Flex Freight Car are used by SBB Cargo within the "Swiss Split 2" business case which aims at the broadening of the traditional scope of SWL transports by integrating intermodal solutions. "Swiss Split 2" focusses on the delivery of maritime containers to sidings with the aid of the encompassing Swiss SWL transport network. The critical mass for a viable SWL system and its efficiency were improved. The new equipment helps considerably to realize cost efficient transport solutions and meet the customers' needs.

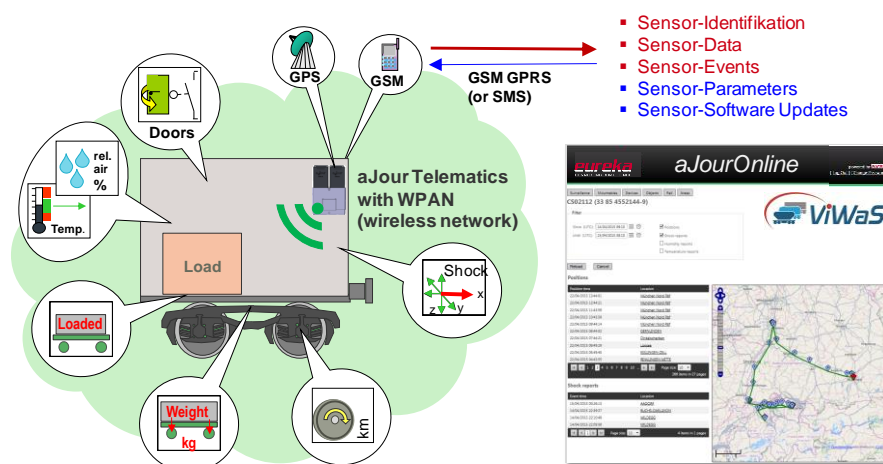
### Smart wagon telematics

In the scope of the ViWaS project, the general need for single wagon monitoring and specific requirements for data visualization to the stakeholders of railway transports has been specified. As a result of the project work the aJourOnline telematics IT platform concept has been developed by project partner Eureka Navigation Solutions AG.

This aJourOnline platform is an interface service that ensures a direct data supply to railway lead contractors, railway sub-contractors, service departments and shippers. Eureka used the experiences gathered during the ViWaS project to adapt the aJourOnline platform for the needs of DB Schenker Rail and its customers. The individual adaption leads to an optimised visualization of location and status data of DB Schenker's freight wagon fleet.

The data quality and availability was also significantly enhanced, thanks to a new generation of telematics devices. Improved sensors and optimised design led to a cost cut of more than 50% in the capital and operations expenses, while at the same time the variety of information types and the frequency of data transmission was increased. According to field tests precise information on the location of a wagon can be given in more than 97% of all cases, even in situations where no GPS is available (GSM data). With the aid of the new developed loading sensor with weighing function, a full exploitation of payload is possible, while at the same time the risk of overloading (with far reaching consequences) is eliminated. Together with the mileage counter a decisive contribution to rail safety is made.

**Figure 11: aJour wagon telematics**



Source: ViWaS

### New simulation tool for planning and optimising SWL networks

Single wagonload (SWL) traffic in Switzerland has to deal with a rapidly growing passenger traffic which is prioritized in the access to the rail network. Thus, the number of available train paths for SWL is limited. Especially during the peak hour of passenger transport, a lack of train paths for SWL is observed. Even under these restricted



conditions, SWL has to cover all national relations in Switzerland with an overnight service to remain competitive with road transport. Consequently, the production schemes have to be continuously improved to meet these requirements.

Within the ViWaS project, the Institut für Verkehrsplanung und Transportsysteme (IVT) at ETH Zurich has developed WagonSIM, an agent-based simulation tool for SWL transport. It is based on the OpenSource software MatSIM. The tool models the routing of freight wagons according to the routes within the real SWL network.

Therefore, the modelling of two network levels is required. The first level is the production network. This stage comprises the assignment of the access points (sidings) to regional shunting points and shunting yards, including the specific timetables for the trains between these points. The second level is the physical infrastructure with its capacity limitations. The simulation tool enables the development of improved SWL networks and production schemes which are based on eight performance parameters (see Figure 12).

**Figure 12: WagonSIM analysis parameters**

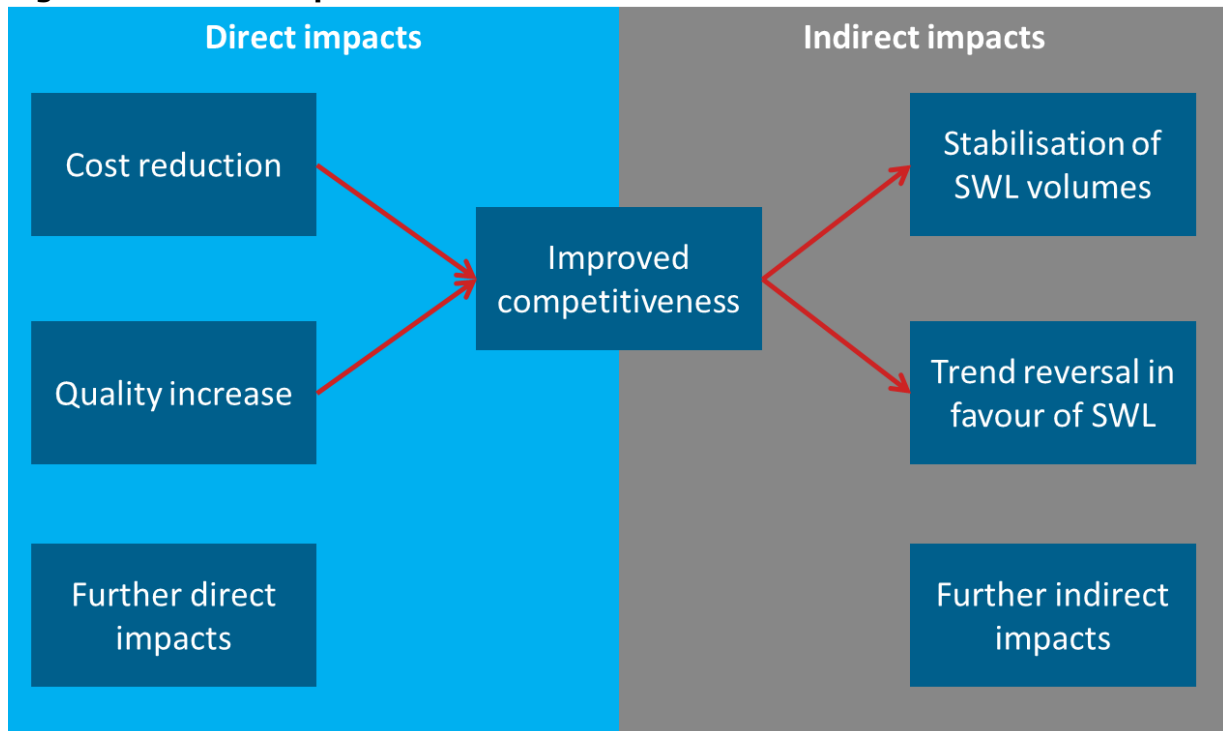
| WagonSIM analysis parameters |                  |             |                  |
|------------------------------|------------------|-------------|------------------|
| Total number of wagons       | Stuck wagons     | Wagon hours | Train kilometres |
| Transported wagons           | Wagon kilometres | Train hours | Tonne kilometres |

Source: ETH Zürich IVT

## 1.4 Actual and potential impact

The impacts initiated by the ViWaS project are clustered in direct and indirect impacts. Direct impacts are immediate results of the ViWaS technologies and developments. Indirect impacts are further effects of the long term application. The main ViWaS impacts are summarised in Figure 13 below.

**Figure 13: ViWaS impacts**



Source: ViWaS

The main part of the ViWaS impacts has been analysed within Deliverable 11 "Evaluation / Recommendations / Implementation strategies". In the following, a short overview is given on the most important impacts:

### Cost reduction

#### Hybrid locomotives

Several ViWaS developments aim at the reduction of costs, either direct or via improved efficiency. Hybrid locomotives have a clear positive impact on the cost structure which was proved in real life by SBB Cargo and theoretically by Bentheimer Eisenbahn. SBB Cargo for instance has managed to keep the prices constant while at the same time the track charges have been raised. This is thanks to the efficient hybrid locomotive which has brought a 34% cost reduction compared to the former used diesel locomotives.

#### Intelligent Telematics

Another cost driver has been successfully addressed by ViWaS. Although the positive impact of telematics devices on wagons is undisputed, the breakthrough has not yet took place due to the high costs and efforts that have been necessary for the deployment and operation. In the course of ViWaS, Eureka has remarkably reduced the telematics costs with its new generation. In comparison with its predecessor, the new device has capital

and operation expenses which have been reduced by 58 %. The functionalities of the enhanced telematics also contribute to the reduction of costs. Exact mileage information contributes to optimise maintenance plans and ensure that the wagons exploit their foreseen mileage. The same applies to the loading sensor which makes optimal loading possible, exploiting the maximum payload while at the same time avoiding the risk of overloads.

#### Last-mile operation

Also in other fields like the last mile operation and optimisation of the railport concept successes have been achieved. NEWOPERA and SNCF Fret have proved that the use of a bi-modal vehicle can lead to significant savings. In the test case of St. Priest the costs per delivery have been reduced by 34 % compared to the normal operation. For neighbouring sidings that could jointly use the bi-modal vehicle, even bigger savings are realistic.

#### Enhancement of the railport concept

For the future of SWL services, it is important that de-centralised regions are not cut off the network which is a huge challenge in the light of decreasing volumes. For this reason the “smaller” optimisation potentials must not be neglected. Bentheimer Eisenbahn has introduced a bunch of measures to optimise operation and reduce costs. The solutions like flexible deployment of staff or the purchase of a new forklift with tailored performance for its tasks are not only beneficial for Bentheimer Eisenbahn. They are rather a blueprint for other European railports.

#### Wagon technologies

Cost reduction is also a guiding principle for wagon technologies. The foldable and stackable Timber Cassette 2.0 was developed by Wascosa to reduce empty runs which are a common problem for unpaired transport flows.

With the container loading adapter, SBB has introduced a new enabler for wagonload services in its Swiss-Split 2 concept. It has a significant positive impact on costs since it facilitates the loading/unloading of containers in private sidings. By the help of the adapter, sea containers, which are the key for standardised and global freight transport, are directly brought to private sidings (even in rural and de-centralised regions) where they can be easily loaded or unloaded. The necessary handling and intermediate transport are skipped.

#### Simulation tool WagonSIM

With WagonSIM, another lever for the optimisation of SWL cost structures has been delivered by ETH Zürich. Wagon SIM is an agent-based simulation tool for SWL transport, based on the Open-Source software MatSIM. The tool models the routing of freight wagons according to the routes within the real SWL network and thus enables the development of improved SWL networks and production schemes.

## Quality increase

ViWaS has not only tackled the cost structure of single wagonload, the project also aimed at qualitative improvements. This applies especially to the evolution of telematics. Thanks to ViWaS, the knowledge about transport relevant data like loading weight, mileage, movement, position etc. is better than ever before. The surveillance of temperature and humidity is also possible which is an important point e.g. for crude steel or chemical products. Last but not least, the status of the wagon doors can be displayed as protection against theft.

The considerations at Bentheimer Eisenbahn made valuable contributions in this respect. Even in decentralised regions, SWL is possible as long as the pure transport is complemented by value added services like warehousing, commissioning etc.

Several of the presented solutions enable or support a clearly faster and more frequent operation of private sidings. In combination with the container loading adapter, the usage of SWL is facilitated.

## Further direct impacts

Besides the achievements on costs and quality, ViWaS has led to further direct impacts which are not always measureable but important. The deployment of hybrid locomotives within Swiss-Split 2 has saved 31% of CO<sub>2</sub> compared to the former use of diesel locomotives. Thereby rail transport extends its lead to road transport which is also important for SBB Cargo customers like Migros who pay dedicated attention to the environmental balance of the transport chain. In addition to the CO<sub>2</sub> reduction, noise, which is also one of the main disturbing factors for residents in the vicinity of sidings, is reduced by state of the art hybrid locomotives, too.

The three main direct impacts, **cost reduction**, **quality increase** and **further direct impacts** are the precondition for an **improved competitiveness** of SWL in Europe. During the project, this improved competitiveness was already proven in small scale. In combination with ViWaS developments, Bentheimer Eisenbahn has managed to stabilise the SWL transport volume, in dedicated sectors even a light increase was achieved. SBB Cargo faces a moderate growth in SWL also thanks to solutions like the Container Loading Adapter or the deployment of the hybrid locomotives. Both companies are working against the general trend which is still not in favour of single wagonload services.

This indicates that the prepared large scale deployment of ViWaS developments could have a significant impact on European wagonload services with stabilised or even growing transport volumes, stopping the current downward trend for SWL or even reaching a trend reversal. A stabilisation of the wagonload network averts further closures of private sidings. Together with the improved cost structure and competitiveness it could even lead to increased reactivations of private sidings, also in countries where SWL has been quitted.

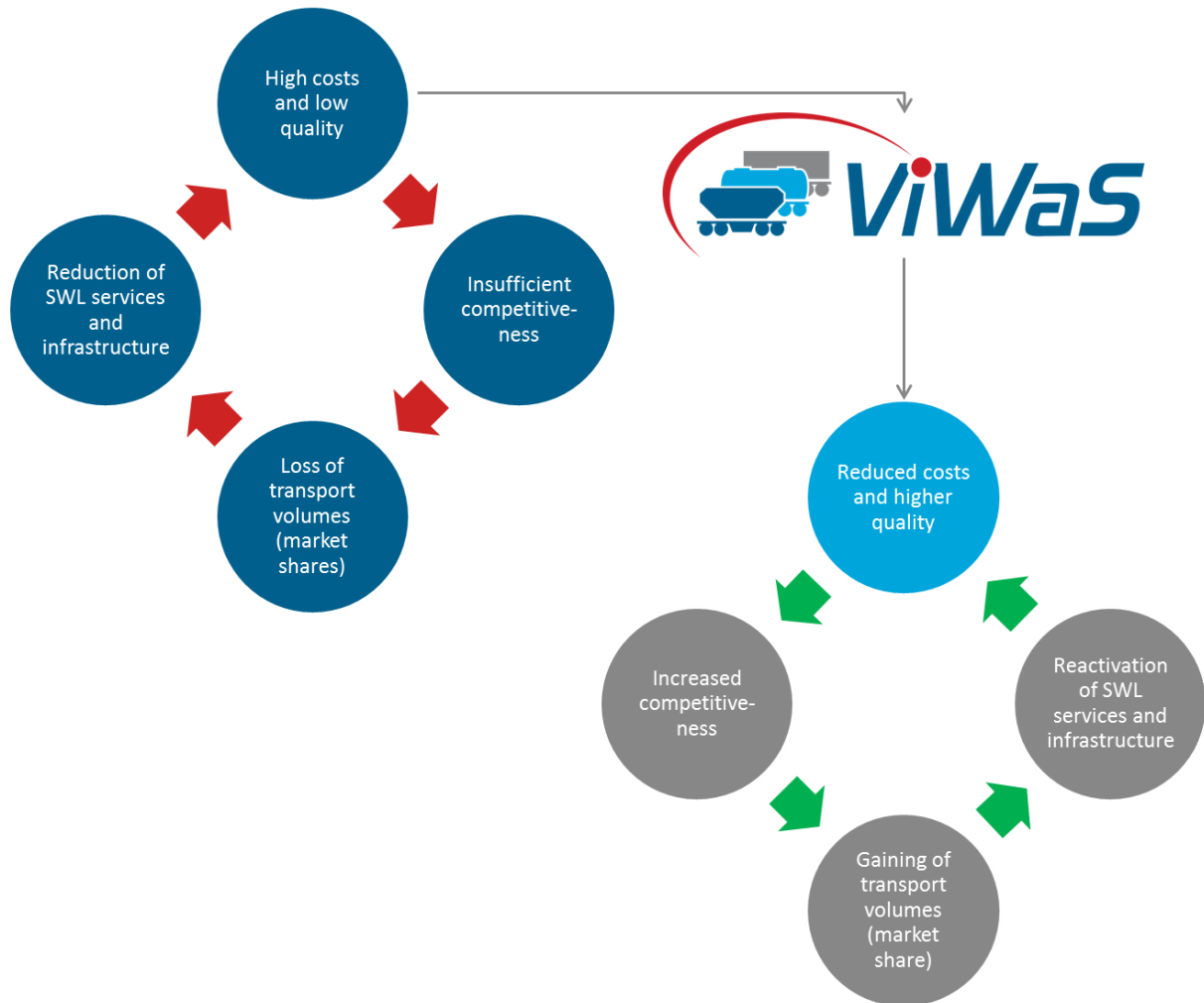
SWL affine industries (which anyway rely on SWL) like steel-, chemistry or automotive can furthermore count on the service and will profit from its higher efficiency. Other transports which have been shifted to road might be shifted back to rail.

In the long run the "reanimation" of SWL will have a positive impact on the environmental balance (reduction of CO<sub>2</sub>) since it gains back transports from road. At the same time, increased safety is another indirect impact of ViWaS. This will be reached in two ways. First, competitive SWL will gain transport volumes from road transport (which causes a higher number of accidents). Second, intelligent telematics, in particular the

mileage counter, increase safety on rail because severe accidents which occur on the basis of exceedances of the maximum mileage can be avoided. This is especially important for the transport of hazardous materials.

In short, ViWaS has developed and analysed a variety of measures and strategies to stop and reverse the vicious circle that has put SWL in a constant decline (Figure 14).

**Figure 14: SWL trend reversal initiated by ViWaS**



Source: ViWaS

Since ViWaS is focused on a very dedicated part of the rail transport system, no dedicated wider societal implications are to be expected.

## 1.5 Dissemination activities

Within the project lifetime the following main dissemination activities have been performed:

- **Facilitating a continuous communication and dissemination process between ViWaS and parties outside the project** e.g. the association of rail forwarders "IBS", Xrail, Shift<sup>2</sup>Rail as well as further initiatives, rail freight experts and customers.
- **Project website for the dissemination of results and other project related information;** accessible under [www.viwas.eu](http://www.viwas.eu).
- **Preparation of project newsletter and other information material** e.g. a PPT chart presentation and a project flyer with public information on the ViWaS project.
- **Preparation and distribution of press releases / coordination with the press.**
- **Publication of project approach and results in international railway journals** e.g. Rail Business, Railway Gazette and International Transport Journal.
- **Presentation of project approach and results at international conferences** e.g. Rail Efficiency (Berlin), STRC Swiss Transport Research Conference (Ascona), INTERMODAL EUROPE (Hamburg), 10th World Congress on Rail Research - WCRR (Sydney), Transport Research Arena –TRA (Paris)
- **Organisation of ViWaS project stands at transport related trade fairs** e.g. InnoTrans (Berlin) and transport logistic (Munich);
- **Organisation of expert workshops** on dedicated ViWaS topics e.g. regarding "SWL in Italy", "Telematics in SWL transport" and "Advanced technologies for SWL transport".
- **Organisation of a final project conference** on 23 October 2015 in Lucerne.
- **Production of a ViWaS film** illustrating the ViWaS technologies timber cassette 2.0, Flex Freight Wagon and the Container Loading Adapter.
- **Further dissemination events** e.g. with IBS, DMG, VDV.

### ViWaS Website

The implementation of a project website is obligatory for each and every project. Since 3 September 2012 - on-time for the project start - the ViWaS project website is online and accessible under [www.viwas.eu](http://www.viwas.eu). It provides information on the ViWaS concept, work packages and partners and has been updated continuously with further project information during the project period. The website design together with project logo and colour concept has been elaborated by AhlersHeinel in cooperation with HaCon as project coordinator.

### **Project Newsletters**

During the project lifetime, four newsletters have been issued. Each version was designated to give a status about the currently performed or recently finished project developments.

- **Newsletter 1 (June 2013)** Intelligent telematics
- **Newsletter 2 (April 2014)** Major cost factor “last mile
- **Newsletter 3 (February 2015)** Cost-benefit analysis hybrid locomotives
- **Newsletter 4 (May 2015)** Deployment of bimodal shunting vehicles

All Newsletters can be downloaded from the ViWaS website.

### **Media articles and press releases**

During the project lifetime, ViWaS was very comprehensive represented in the press and media. A huge part of the ViWaS articles and press releases is available on the project website.

### **Main dissemination events**

In addition to media activities, the ViWaS consortium organised and participated in various dissemination events. Since September 2012, the project counts a huge number of international appearances split up into different categories:

- Conferences and fairs,
- workshops
- and the dedicated ViWaS final conference

Main purposes of the appearances are on the one hand the promotion of project outcomes, on the other gathering feedback provided by business experts to enhance and improve certain project fields to achieve optimal results.

### **Transport logistic 2015**

In May 2015, ViWaS had its largest fair appearance during transport logistic in Munich (May 5 – 8). With regard to the advanced project phase, several outcomes were presented to the logistics audience. Considering the business importance as the largest logistics fair in the world, ViWaS participated with two designated stands (Stand B6, 122 and FGL, stand 804/1- ViWaS wagon as part of “SwissMovers” appearance) in the exhibition. In addition, seven companies out of the consortium presented their solutions (including ViWaS findings) at their own stands.

Located right next to project partners HaCon and Eureka, the indoor stand provided an overview of ViWaS activities. The ViWaS film has been continuously shown on a large screen TV positioned at the back side of the stand. In case visitors asked for more detailed information, a PC station with different ViWaS presentations has been installed. Furthermore, a seating area for discussions and talks has been erected underneath the television.

On the fair ground’s open-air site three technological innovations developed in the scope of ViWaS have been presented to the public. As already pictured in the project film, the Timber Cassette 2.0, the Container Loading Adapter and the Flex Freight Car were installed as part of the “SwissMovers” stand to show the public practical operation examples. Thus, the key features of the ViWaS outcomes have been emphasised:



- Loaded Timber Cassette 2.0 to show ability to transport truckloads of wood with only on cassette;
- Walkable Flex Freight Car to underline accessibility by forklifts;
- Container Loading Adapter underneath a standard 40' container to demonstrate the use of the additional platform on the wagon

**Figure 15: ViWaS stand in hall B6 (transport & logistics 2015)**



Source: HaCon

On 6 May 2015, a designated ViWaS event took place in the "SwissMovers" pavilion to provide attendees with background information about the project developments.

**Figure 16: ViWaS event at transport logistic 2015**



Source: HaCon



## **Final Conference**

The Final Conference of ViWaS took place on 23 October 2015 in Lucerne in the Swiss Museum of Transport and counted some 80 participants – mostly high level representatives from the transport & logistics sector. The conference concept was made of the following elements:

- Presentation of ViWaS achievements (organisational improvements + technical innovations);
- Panel discussion;
- Exhibition of prototype ViWaS wagon technologies (Wascosa Flex Freight Car and Timber Cassette 2.0 + Container Loading Adapter of SBB Cargo);
- Project partner stands (HaCon – ViWaS issues + Further EU studies; Eureka – telematics innovations);
- Networking opportunities during the breaks.

The conference programme itself is listed below:

Introduction by ViWaS project manager Niklas Galonske (HaCon) and Gerhard Troche (DG MOVE), Moderator during the entire conference: Marian Gaidzik (HaCon).

Session 1 "New Organisational Structures for Less-than-trainload Services":

- The Swiss Way for a Renewed Rail Freight System (Patrik Dober, SBB Cargo);
- Bundling in Rail Logistic Centres Enable Single Wagonload Services in Regional Areas (Joachim Berends, Bentheimer Eisenbahn);
- Lean Solutions for Last Mile operations (Denis Lévy, Fret SNCF).

Session 2 "Efficiency Increase through New Technologies":

- WagonSim - Simulation Tool for Optimisation of Wagon-based Production Schemes (Dirk Bruckmann, University Rhein-Waal);
- Modular Freight Wagons for Flexibility in Rail Transport (Irmhild Saabel, Wascosa);
- Smart telematics in Rail Freight (Victor Behrends, Eureka).

Concluding panel discussion on the topic "Single Wagonload in the Year 2030 - Disappeared or Still Viable"; Moderator Marian Gaidzik (HaCon) discussed with widely acknowledged experts from the rail freight and logistics sector:

- Olaf Krüger (Chairman of Board IBS);
- Joachim Berends (CEO Bentheimer Eisenbahn, Vice President Association of German Transport Companies (VDV));
- Armand Toubol (Vice Chairman NEWOPERA);
- Gerhard Troche (European Commission, DG MOVE);
- Sassan Rabet (CEO Xrail).

**Figure 17: ViWaS final conference**



*a. Niklas Galonske (HaCon) opening the conference, Source: HaCon*



*b. Partner stand of Eureka, Source: HaCon*



*c. Introduction by Gerhard Troche (EC, DG MOVE), Source: HaCon*



*d. Exhibition of ViWaS wagon technologies; explanation by Patrik Dober (SBB Cargo), Source: HaCon*

**Figure 18: Final conference audience and panel discussion**



Source: HaCon

### **Other dissemination meetings**

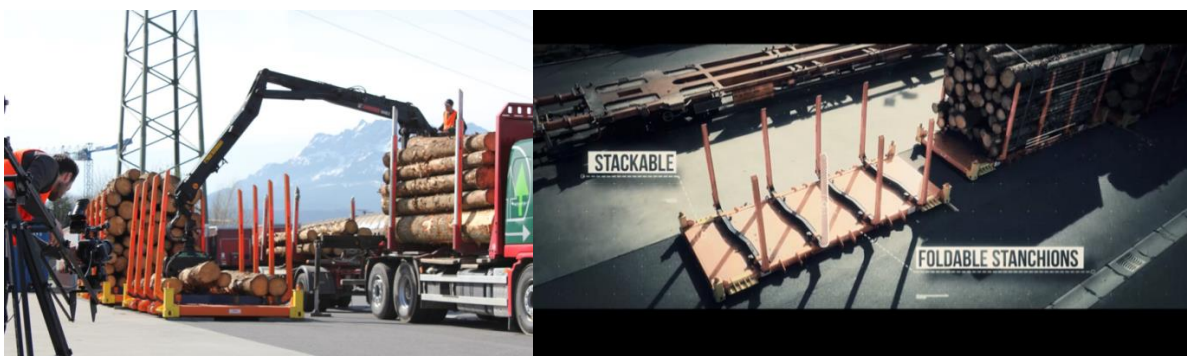
More than 30 additional meetings took place with ViWaS participation. In these meetings, the project idea, approach and results were presented to a broad audience. The meetings were also used to gain feedback from different stakeholders and to discuss about the European wide applicability of the developed solutions.

### **ViWaS film**

Improved SWL technologies are an important ViWaS element for the strengthening of SWL transport. A film has been evaluated as the most appropriate medium to show the elements of these innovations and especially their application in real life situations. The film consists of three parts dedicated to the following developments:

- Container Loading Adapter;
- Flex Freight Car;
- Timber Cassette 2.0

**Figure 19: ViWaS film**



Source: HaCon (left), GSP (right)

## 1.6 Miscellaneous

Public website: [www.viwas.eu](http://www.viwas.eu)

Project Coordinator: Lars Deiterding  
HaCon Ingenieurgesellschaft mbH  
Lister Straße 15  
30163 Hannover, Germany  
Phone: +49 511 33699 132  
Fax: +49 511 33699 99

**Figure 20: Project Logo**



Source: ViWaS, AhlersHeinel

**Table 1: ViWaS Beneficiaries**

| Beneficiary                                   | Country     | Contact person  |
|---|-------------|---|
| HaCon Ingenieurgesellschaft mbH               | Germany     | Niklas Galonske<br>HaCon Ingenieurgesellschaft mbH<br>Lister Straße 15<br>30163 Hannover<br>Email: niklas.galonske@hacon.de |
| Bentheimer Eisenbahn AG                       | Germany     | Arno Boll<br>Bentheimer Eisenbahn AG<br>Otto Hahn Straße 1<br>48529 Nordhorn<br>Email: a.boll@kraftverkehr-emsland.de       |
| Eidgenoessische Technische Hochschule Zuerich | Switzerland | Albert Mancera<br>ETH Zürich<br>Raemistrasse 101<br>8092 Zürich<br>Email: albert.mancera@ivt.baug.ethz.ch                   |
| Eureka Navigation Solutions AG                | Germany     | Victor Behrends<br>Eureka Navigation Solutions AG<br>Bremer Straße 11<br>80807 München<br>Email: victor.behrends@eureka.de  |
| Societe Nationale des chemins de fer Francais | France      | Denis Lévy<br>Fret SNCF<br>Rue de Commandant Rene Mouchotte 34<br>75014 Paris<br>Email: denis.levy@sncf.fr                  |
| Consorzio IB Innovation                       | Italy       | Giuseppe dall'Asta<br>Consorzio IB Innovation<br>Via Altabella 15<br>40126 Bologna<br>dallasta@bo.interporto.it             |
| NEWOPERA Aisbl                                | Belgium     | Franco Castagnetti<br>c/o ITALCONTAINER, Via Valtellina 7<br>20159 Milan<br>Email: franco.castagnetti@newopera.org          |
| SBB Cargo AG                                  | Switzerland | Patrik Dober<br>SBB Cargo AG<br>Centralbahnstraße 4<br>4065 Basel<br>Email: patrik.dober@sbbcargo.com                       |
| Technische Universität Berlin                 | Germany     | Armando Carrillo Zanuy<br>TU Berlin<br>Straße des 17. Juni 135<br>10623 Berlin<br>Email: acarrillo@railways.tu-berlin.de    |
| Wascosa AG                                    | Switzerland | Irmhild Saabel<br>Wascosa AG<br>Werftestraße 4<br>6005 Luzern<br>Email: irmhild.saabel@wascosa.ch                           |



Figure 21: ViWaS partners –company logos



Source: ViWaS

## 2 Use and dissemination of foreground

| List of scientific (peer reviewed) publications relating to the foreground of the project |       |             |                                       |                           |           |                      |                     |                |                                      |  |
|---|-------|-------------|---------------------------------------|---------------------------|-----------|----------------------|---------------------|----------------|--------------------------------------|--|
| No.   | Title | Main author | Title of the periodical or the series | Number, date or frequency | Publisher | Place of publication | Year of publication | Relevant pages | Permanent identifiers (if available) | Is/will open access provided to this publication ? |
| -   | -     | -           | -                                     | -                         | -         | -                    | -                   | -              | -                                    | -  |

| List of main dissemination activities |                    |             |                                      |               |           |  |                  |                     |
|---------------------------------------|--------------------|-------------|--------------------------------------|---------------|-----------|--|------------------|---------------------|
| No.                                   | Type of activities | Main leader | Title                                | Date / Period | Place     | Type of audience                               | Size of audience | Countries addressed |
| 1                                     | Conference         | NEWO        | European Freight and Logistics Forum | 26. Nov. 2015 | Barcelona | Freight and Logistics experts and stakeholders | 70               | European            |

| List of main dissemination activities |                    |             |   |               |        |   |                  |                     |
|---------------------------------------|--------------------|-------------|---|---------------|--------|---|------------------|---------------------|
| No.                                   | Type of activities | Main leader | Title   | Date / Period | Place  | Type of audience  | Size of audience | Countries addressed |
| 2                                     | Conference         | NEWO        | Cinquième Journée de rencontres et d'échanges OFP | 05. Nov. 2015 | Paris  | Railway stakeholders  | 300+             | France              |
| 3                                     | Final Conference   | HaCon       | Perspectives for Single Wagonload                 | 23 Oct. 2015  | Luzern | European Parliament Members, Railway stakeholders             | 100              | European            |
| 4                                     | Fair               | HaCon       | Transport logistic 2015                           | 5-8 May 2015  | Munich | Railway Stakeholder (Railway Undertakers, Shippers, Industry) | Broad            | European            |
| 5                                     | Newsletter IV      | HaCon       | Transport logistic 2015                           | 5-8 May 2015  | -      | Public  | Broad            | European            |
| 6                                     | Film               | HaCon       | ViWaS Film  | 1 May 2015    | -      | Public  | Broad            | European            |



| List of main dissemination activities |                    |             |                         |                  |        |   |                  |                     |
|---------------------------------------|--------------------|-------------|-------------------------|------------------|--------|---|------------------|---------------------|
| No.                                   | Type of activities | Main leader | Title                   | Date / Period    | Place  | Type of audience  | Size of audience | Countries addressed |
| 7                                     | Newsletter III     | HaCon       | Innotrans               | 1 Feb. 2015      | -      | Public  | Broad            | European            |
| 8                                     | Fair               | HaCon       | Innotrans               | 23-26 Sept. 2014 | Berlin | Railway Stakeholder (Railway Undertakers, Shippers, Industry) | Broad            | European            |
| 9                                     | Newsletter II      | HaCon       | Innotrans               | 1 Apr. 2014      |        | Public  | Broad            | European            |
| 10                                    | Fair               | HaCon       | transport logistic 2013 | 4-7 Jun. 2013    | Munich | Railway Stakeholder (Railway Undertakers, Shippers, Industry) | Broad            | European            |
| 11                                    | Newsletter I       | HaCon       | Innotrans               | 1 Jun. 2013      | -      | Public  | Broad            | European            |

| List of main dissemination activities |                    |             |              |               |       |                  |                  |                     |
|---------------------------------------|--------------------|-------------|--------------|---------------|-------|------------------|------------------|---------------------|
| No.                                   | Type of activities | Main leader | Title        | Date / Period | Place | Type of audience | Size of audience | Countries addressed |
| 12                                    | Website            | HaCon       | www.viwas.eu | 1 Sept. 2012  | -     | -                | Broad            | Worldwide           |

| List of Applications for patents, trademarks, registered designs, etc. |                              |                                  |  |                                 |                                      |
|--|------------------------------|----------------------------------|--|---------------------------------|--------------------------------------|
| Type of IP Rights  | Confidential Click on YES/NO | Foreseen embargo date dd/mm/yyyy | Application reference(s) (e.g. EP123456) | Subject or title of application | Applicant(s) (as on the application) |
| -  | -                            | -                                | -  | -                               | -                                    |

| List of Exploitable foregrounds   |   |               |                       |                                      |   |  |  |                                       |
|---|---|---------------|-----------------------|--------------------------------------|---|--|--|---------------------------------------|
| Type of Exploitable Foreground  | Description of exploitable foreground   | Confidential? | Foreseen Embargo date | Exploitable product(s) or measure(s) | Sector(s) of application                    | Timetable, commercial or any other use | Patents or other IPR exploitation (licenses) | Owner & Other Beneficiary(s) involved |
| General advancement of knowledge / Commercial exploitation of R&D results | WagonSIM is a simulation tool for (Single) Wagonload traffic. The model has been developed as an agent-based simulation on MATSim basis to optimise SWL transportation. The model reproduces in a two layer structure, the infrastructure and the operation of the SWL network. Therefore it allows to model improvements in infrastructure, schedule and shunting operations. In order to deliver accurate results, various analysis parameters are considered. Consequently, wagonSIM enables the development of improved SWL networks and production schemes based on 8 performance parameters (total number of wagons, transported wagons, stuck wagons, wagon kilometres, wagon hours, train hours, train kilometres, tonne kilometres, etc.). The software is open source, therefore the applications of this | No            | -                     | wagonSIM                             | Organisation of (Single) Wagonload services | Ready for use and further deployment   | -  | ETHZ                                  |

| List of Exploitable foregrounds  |   |               |                       |   |                                 |  |  |                                       |
|----------------------------------|---|---------------|-----------------------|---|---------------------------------|--|--|---------------------------------------|
| Type of Exploitable Foreground   | Description of exploitable foreground   | Confidential? | Foreseen Embargo date | Exploitable product(s) or measure(s)          | Sector(s) of application        | Timetable, commercial or any other use   | Patents or other IPR exploitation (licenses) | Owner & Other Beneficiary(s) involved |
|                                  | research project can be implemented by rail operators and IMs. The data used to design the model is private, it belongs to SBB. Thus, the model cannot be distributed as a closed package. Nevertheless, the developed concept can be implemented in any type of freight network that performs under fixed schedule, e.g., SWL, inland waterways networks, road freight distribution networks, etc. |               |                       |   |                                 |  |  |                                       |
| General Advancement of Knowledge | New 'last-mile' concepts for improved operation efficiency. These concepts seek to reduce the overall (Single) Wagonload production costs. Three approaches have been determined and elaborated: (1) optimised collection/delivery concept based on containerised cargo, (2) traction schemes using hybrid locomotives for streamlined operation and reduced costs, and (3) deployment of bi-modal  | No            | -                     | Innovative methods for 'last-mile' operations | Last-mile services in terminals | Immediate efficiency of existing sidings and with a higher effect on new sidings will produce short term developments confirmed by interest of a large manufacturer to | -  | Fret SNCF and NEWOPERA                |

| List of Exploitable foregrounds        |   |               |                       |                                      |   |  |  |                                       |
|--|---|---------------|-----------------------|--------------------------------------|---|--|--|---------------------------------------|
| Type of Exploitable Foreground         | Description of exploitable foreground   | Confidential? | Foreseen Embargo date | Exploitable product(s) or measure(s) | Sector(s) of application                                    | Timetable, commercial or any other use                   | Patents or other IPR exploitation (licenses)                             | Owner & Other Beneficiary(s) involved |
|  | shunting engines for separated train movements and shunting in terminals.   |               |                       |                                      |   | homologate rapidly its equipment on the railway network. |  |                                       |
| Commercial Exploitation of R&D results | Lightweight, modular container wagon designed for deployment with different superstructures that features additional inlays to cover gaps in the wagon frame. Through these inlays the wagon is drivable by forklift to improve (un)loading procedures in private sidings.  | No            | -                     | Flex Freight Car                     | Intermodal transports (prepared for use in private sidings) | Ongoing  | CH Patent 700 850/ P417CH<br>CH Markenreg. "WASCOSA FLEX FREIGHT SYSTEM" | Wascosa AG                            |
| Commercial Exploitation of R&D results | Intermodal superstructure for logwood transports. Cassette features foldable stanchions that enable space-saving storage on the terminal site or stacked transport of empty cassettes on train to enable additional container transports. Stackable design leads to increased transport efficiency (less empty runs). | No            | -                     | Timber Cassette 2.0                  | Intermodal logwood transport (rail/road)                    | Ongoing  | -  | Wascosa AG                            |

| List of Exploitable foregrounds        |  |               |                       |  |  |   |  |                                       |
|--|--|---------------|-----------------------|--|--|---|--|---------------------------------------|
| Type of Exploitable Foreground         | Description of exploitable foreground  | Confidential? | Foreseen Embargo date | Exploitable product(s) or measure(s)                                   | Sector(s) of application   | Timetable, commercial or any other use  | Patents or other IPR exploitation (licenses) | Owner & Other Beneficiary(s) involved |
| Commercial Exploitation of R&D results | Optimised on-board telematics processing unit with advanced installation/maintenance procedures. Unit collects data from different sensors (GPS, temperature, three-axis shock, motion, mileage counter, loading) and transmission via WPAN. Goal: Set-up of a telematics data interface service (software) that provides with stakeholder-specific information. | No            | -                     | Intelligent Telematics, universal Smart-Sensor, Load Sensor for wagons | Asset intelligence for freight wagons, real time rail freight monitoring | First series production of ViWaS generation telematics started December 2015  | -  | Eureka Navigation Solutions AG        |
| Commercial exploitation of R&D results | Lightweight platform (20') for standard 60' container wagons. Two benefits are achieved by the platform: (1) Bridges height differences between wagon surface and platforms in private sidings, (2) even surface without gaps allow forklifts to drive on the wagon for improved (un) loading procedures.  | No            | 01/01/16              | Container Loading Adapter  | Intermodal transports  | February 2016: step-by-step implementation into daily operation. It is planned to equip more than 140 container wagons with the adapters. | Copyright on the plans                       | SBB Cargo                             |

### 3 Report on societal implications

#### A General Information *(completed automatically when Grant Agreement number is entered.)*

|                                |   |
|--------------------------------|---|
| Grant Agreement Number:        | 314255                                      |
| Title of Project:              | Viable Wagonload production Schemes - ViWaS |
| Name and Title of Coordinator: | Lars Deiterding                             |

#### B Ethics

##### 1. Did your project undergo an Ethics Review (and/or Screening)?

- If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports?

Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'

No

##### 2. Please indicate whether your project involved any of the following issues (tick box) :

###### RESEARCH ON HUMANS

|   |    |
|---|----|
| • Did the project involve children?                         | No |
| • Did the project involve patients?                         | No |
| • Did the project involve persons not able to give consent? | No |
| • Did the project involve adult healthy volunteers?         | No |
| • Did the project involve Human genetic material?           | No |
| • Did the project involve Human biological samples?         | No |
| • Did the project involve Human data collection?            | No |

###### RESEARCH ON HUMAN EMBRYO/FOETUS

|   |    |
|---|----|
| • Did the project involve Human Embryos?                                  | No |
| • Did the project involve Human Foetal Tissue / Cells?                    | No |
| • Did the project involve Human Embryonic Stem Cells (hESCs)?             | No |
| • Did the project on human Embryonic Stem Cells involve cells in culture? | No |

|   |   |
|---|---|
| • Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?   | No  |
| <b>PRIVACY</b>  |   |
| • Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)? | No  |
| • Did the project involve tracking the location or observation of people?   | No  |
| <b>RESEARCH ON ANIMALS</b>  |   |
| • Did the project involve research on animals?  | No  |
| • Were those animals transgenic small laboratory animals?   | No  |
| • Were those animals transgenic farm animals?   | No  |
| • Were those animals cloned farm animals?   | No  |
| • Were those animals non-human primates?  | No  |
| <b>RESEARCH INVOLVING DEVELOPING COUNTRIES</b>  |   |
| • Did the project involve the use of local resources (genetic, animal, plant etc)?  | No  |
| • Was the project of benefit to local community (capacity building, access to healthcare, education etc)?   | No  |
| <b>DUAL USE</b>   |   |
| • Research having direct military use   | No  |
| • Research having the potential for terrorist abuse   | No  |
| <b>C Workforce Statistics</b>   |   |
| <b>3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).</b>                         |   |
| <b>Type of Position</b>   | <b>Number of Women      Number of Men</b> |
| Scientific Coordinator  | 1   |
| Work package leaders  | 0      5                                  |
| Experienced researchers (i.e. PhD holders)  | 1      5                                  |
| PhD Students  |   |
| Other   | 4      30                                 |
| <b>4. How many additional researchers (in companies and universities) were recruited specifically for this project?</b>   | <b>&gt;45</b>                             |
| Of which, indicate the number of men:   | >30                                       |



## D Gender Aspects

|   |   |           |
|---|---|-----------|
| <b>5. Did you carry out specific Gender Equality Actions under the project?</b> | X | Yes<br>No |
|---|---|-----------|

**6. Which of the following actions did you carry out and how effective were they?**

|   | Not at all effective | Very effective |
|---|----------------------|----------------|
| <input type="checkbox"/> Design and implement an equal opportunity policy         | ○ ○ ○ ○ ○            |                |
| <input type="checkbox"/> Set targets to achieve a gender balance in the workforce | ○ ○ ○ ○ ○            |                |
| <input type="checkbox"/> Organise conferences and workshops on gender             | ○ ○ ○ ○ ○            |                |
| <input type="checkbox"/> Actions to improve work-life balance                     | ○ ○ ○ ○ ○            |                |
| <input type="radio"/> Other: <input type="text"/>                                 |                      |                |

**7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?**

☐ Yes- please specify

X No

## E Synergies with Science Education

**8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?**

☐ Yes- please specify

X No

**9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?**

☐ Yes- please specify

X No

## F Interdisciplinarity

**10. Which disciplines (see list below) are involved in your project?**

|   |  |
|---|--|
| <input checked="" type="radio"/> Main discipline <sup>1</sup> : 1.4 2.1 2.3 5.4<br><input type="radio"/> Associated discipline <sup>1</sup> :   | <input type="radio"/> Associated discipline <sup>1</sup> :       |
| <b>G Engaging with Civil society and policy makers</b>  |  |
| <b>11a Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14)</b>   | <input type="radio"/> Yes<br><input checked="" type="radio"/> No |
| <b>11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?</b><br><input type="radio"/> No<br><input type="radio"/> Yes- in determining what research should be performed<br><input type="radio"/> Yes - in implementing the research<br><input type="radio"/> Yes, in communicating /disseminating / using the results of the project |  |
| <b>11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?</b>   | <input type="radio"/> Yes<br><input type="radio"/> No            |
| <b>12. Did you engage with government / public bodies or policy makers (including international organisations)</b><br><input type="radio"/> No<br><input type="radio"/> Yes- in framing the research agenda<br><input type="radio"/> Yes - in implementing the research agenda<br><input type="radio"/> Yes, in communicating /disseminating / using the results of the project                               |  |
| <b>13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?</b><br><input type="radio"/> Yes – as a <b>primary</b> objective (please indicate areas below- multiple answers possible)<br><input type="radio"/> Yes – as a <b>secondary</b> objective (please indicate areas below - multiple answer possible)<br><input type="radio"/> No                 |  |
| <b>13b If Yes, in which fields?</b>   |  |

<sup>1</sup> Insert number from list below (Frascati Manual).

|   |                                |                               |  |
|---|--------------------------------|-------------------------------|--|
| Agriculture                               | Energy                         | Human rights                  |  |
| Audiovisual and Media                     | Enlargement                    | Information Society           |  |
| Budget                                    | Enterprise                     | Institutional affairs         |  |
| Competition                               | Environment                    | Internal Market               |  |
| Consumers                                 | External Relations             | Justice, freedom and security |  |
| Culture                                   | External Trade                 | Public Health                 |  |
| Customs                                   | Fisheries and Maritime Affairs | Regional Policy               |  |
| Development Economic and Monetary Affairs | Food Safety                    | Research and Innovation       |  |
| Education, Training, Youth                | Foreign and Security Policy    | Space                         |  |
| Employment and Social Affairs             | Fraud                          | Taxation                      |  |
|   | Humanitarian aid               | Transport                     |  |

**13c If Yes, at which level?**

- ☐ Local / regional levels
- ☐ National level
- ☐ European level
- ☐ International level

**H Use and dissemination**

**14. How many Articles were published/accepted for publication in peer-reviewed journals?** **0**

**To how many of these is open access<sup>2</sup> provided?**

**How many of these are published in open access journals?**

**How many of these are published in open repositories?**

**To how many of these is open access not provided?**

**Please check all applicable reasons for not providing open access:**

- ☐ publisher's licensing agreement would not permit publishing in a repository
- ☐ no suitable repository available
- ☐ no suitable open access journal available
- ☐ no funds available to publish in an open access journal
- ☐ lack of time and resources
- ☐ lack of information on open access
- ☐ other<sup>3</sup>: .....

**15. How many new patent applications ('priority filings') have been made?** **0**  
*("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*

**16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).**

|                   |          |
|-------------------|----------|
| Trademark         | <b>0</b> |
| Registered design | <b>0</b> |
| Other             | <b>0</b> |

**17. How many spin-off companies were created / are planned as a direct result of the project?** **0**

*Indicate the approximate number of additional jobs in these companies:* **0**

<sup>2</sup> Open Access is defined as free of charge access for anyone via Internet.

<sup>3</sup> For instance: classification for security project.

**18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:**

- |   |  |
|---|--|
| <input type="checkbox"/> Increase in employment, or                       | <input type="checkbox"/> In small & medium-sized enterprises |
| <input type="checkbox"/> Safeguard employment, or                         | <input type="checkbox"/> In large companies                  |
| <input type="checkbox"/> Decrease in employment,                          | X None of the above / not relevant to the project            |
| <input type="checkbox"/> Difficult to estimate / not possible to quantify |  |

**19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (FTE = one person working fulltime for a year) jobs:**

Indicate figure:

Difficult to estimate / not possible to quantify

X

## I Media and Communication to the general public

**20. As part of the project, were any of the beneficiaries professionals in communication or media relations?**

☐ Yes ☒ No

**21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?**

☐ Yes ☒ No

**22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?**

- |  |   |
|--|---|
| X Press Release                                  | X Coverage in specialist press  |
| <input type="checkbox"/> Media briefing          | X Coverage in general (non-specialist) press                                      |
| <input type="checkbox"/> TV coverage / report    | X Coverage in national press  |
| <input type="checkbox"/> Radio coverage / report | <input type="checkbox"/> Coverage in international press                          |
| X Brochures /posters / flyers                    | X Website for the general public / internet                                       |
| X DVD /Film /Multimedia                          | X Event targeting general public (festival, conference, exhibition, science café) |

**23 In which languages are the information products for the general public produced?**

- |  |           |
|--|-----------|
| <input type="checkbox"/> Language of the coordinator | X English |
| <input type="checkbox"/> Other language(s)           |           |