SMART RAIL

Smart Supply Chain Oriented Rail Freight Services

GA No. 636071

Deliverable No.	D8.3
Deliverable Title	Information exchange for necessary level of transparency

Document ID	Smart-RailD8.3
Dissemination level	Public
Main Author	Thijs Smit - TNO
Issue date	8 July-2016

EUROPEAN COMMISSION MOVE HORIZON2020 – Research and Innovation Action

Disclaimer and acknowledgement

This project has received funding from the European Union's Horizon 2020 Programme Research and Innovation action under grant agreement No 636071

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Smart-Rail consortium

Document information

Additional author(s) and contributing partners

Name	Organisation
Wolf Dietrich-Geitz	Railistics
Paul Melia	Railistics

Document Change Log

Version	Date	Comments
v0.1		First draft of document
v0.x		Revised version based on the comments of Name Reviewer(s) - Organisation
v1.0		First final version, approved by Executive Board, (will be) submitted to EC.
v1.1		First draft based upon first final version
v2.0		Second final version, approved by Executive Board, (will be) submitted to EC.

Document Distribution Log

Version	Date	Distributed to
v0.1	01-June-2016	Oliver Maurel (H-Log) Gino Pfister (Ecco-Rail)
V0.2	05-July-2016	Oliver Maurel (H-Log) Gino Pfister (Ecco-Rail)

Verification and approval

	Name	Date
Verification Final Draft by WP leader	Jaco van Meijeren	6-7-2016
Approval Final Deliverable by coordinator	Mr Paul Tilanus	7-7-2016

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Definitions & Abbreviations

ATA	Actual Time of Arrival
ATD	Actual Time of Departure
ECT	European Container Terminals
EGS	European Gateway Services
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
NEXT	IT Tool currently under development by DB Netz
RFC	Rail Freight Corridor
RNE	Rail Net Europe
RTW	Rail Terminal West
TIS	Train Information System

1. Introduction

1.1 Background

Modal shift from road to the rail sector, mentioned in the White Paper on Transport [1] as well as other European and national policy papers, faces the challenge of providing the capacity for affordable and attractive services. The current European rail freight market is a complex system involving a great number of public and private stakeholders, such as infrastructure managers, rail operators, terminal operators and freight forwarders who jointly manage the operation of running trains from A to B. This complexity in the rail sector hampers the development of efficient and competitive rail freight services. Smart-Rail intends to contribute to the European policy targets by defining, implementing and monitoring new shipper-oriented rail freight concepts improving the competitive position of the rail sector in the Rhine-Alpine Corridor. In line with the Living Lab approach, the activities will start with simple measures and in next steps these will be more complex and cover a wider scope. Therefore, instead of analysing the full Rhine- Alpine corridor, in a first step, we focus on a part of this corridor: Rotterdam – Ruhr Area in Germany. In addition, the Smart-Rail project is aligned to the objectives of SHIFT²RAIL[1] and its results will be used, in further, in this programme.

More specifically, the objectives of Smart-Rail are:

- to contribute to a mental shift of the rail sector toward a client and supply chain -oriented focus;
- to develop working business models for cooperation of different stakeholders;
- to develop a methodology and architecture for exchange of data/information required for the optimisation process, between stakeholders, making use of existing initiatives where available (for instance the European Corridor Management and national logistical information centres);
- to establish three Living Labs that each focus on different aspects and markets and develop tools, methodologies and concepts. The purpose of the Living Labs[2] is to test, monitor and improve the innovative measures in real life conditions. Specific and more dedicated business models, information systems and new rail services will also be tested.

Central point of this Work Package is to improve flexibility and reliability in rail freight transport at competitive prices in line with the needs of the clients (shippers, logistic service providers) as in case of (un)expected disruptions on the rail network. Such improvement of the service, might agitate modal shift from road to rail.

Seven separate tasks are defined in the Description of Work (DoW) document to structure the work:

1. Problem analysis and the selection of relevant measures. In this step background information of the current situation will be described. In addition measures will be selected and designed. The focus of this task is to outline the first design of the selected measures.

[1] SHIFT²RAIL is a rail joint technology initiative focussed on turning research and innovation (R&I) actions to market-driven solutions and accelerating the integration of new and advanced technologies into innovative rail product solutions (http://www.shift2rail.org/).

[2] A Living Lab or Continuous Improvement Track is a test environment for the cyclical development and evaluation of complex, innovative concepts and technology, as part of a real world, operational system, in which multiple stakeholders with different backgrounds and interests work together towards a common goal, as part of medium to long-term study.

2. Potential impact of measures for different stakeholders; This task will present the Key Performance Indicators (KPIs) used to monitor the impact of the measures on the corridor. A tool will be developed to show the quantitative impact in a fast and user friendly way. The tool in combination with stakeholder sessions will be used to raise awareness of and support for the implementation.
3. Information exchange for necessary level of transparency; In this task, the necessary data transparency to improve flexibility and reliability will be analysed. In addition, the willingness to share data will be discussed with stakeholders.
4. Alignment of value case for involved stakeholders that is needed for cooperation; Task 8.1, 8.2 and 8.3 will be consulted to determine business cases for measures and for different types of stakeholders on the Rail Freight Corridor.
5. Implementation of measures and design of monitoring approach; Results from all previous tasks will be implemented in a living lab environment. Within this Living Lab, continuous improvement will be monitored via a plan, do, check & act cycle, using the KPIs as identified in task 8.2.
6. Monitoring and adjustment of measures; The monitoring approach as developed will be used to continuously improve the measures taken on the corridor. Furthermore, additional measures might be implemented in this phase of the project.
7. Conclusion and recommendations; A final assessment of the results in this Living Lab is made. Furthermore, recommendations will be made to ensure durability of the living lab and the replicability of the impact on other Rail Freight Corridors.

1.2 Task 8.3 objectives

The primary focus of Task 8.3 'information exchange for necessary level of transparency' is to identify the expected benefits for sharing data between stakeholders. For each measure, the currently available data of each stakeholder is described, for which purpose it is used and what kind of data is needed to improve flexibility, efficiency, visibility and reliability that is not currently being shared. At the same time, conditions for sharing data are outlined.

1.3 Structure of the deliverable

As described before, in Deliverable 8.1 the selection of measures that will be elaborated in this Living Lab have been described. In Deliverable 8.2 the potential impact of these selected measures are illustrated.

Deliverable 8.3 focuses on the information exchange that is necessary for the implementation of the measures.

Deliverable 8.4 describes the alignment of the value case for involved stakeholders. Deliverable 8.5 describes the implementation of measures and the design of the monitoring approach.

Overall, Deliverables 8.1 to 8.5 give an overview of all the preparations that are needed for the actual implementation of the measures in the Living Lab approach in a number of cycles that will be described in Deliverable 8.6.

2. Information and data exchange

Goal of this Living Lab

The goal of this Living Lab is to test, implement, evaluate and further develop measures identified by and with stakeholders in an effort to improve the rail service. As mentioned in task 8.1, stakeholders made it clear that there is a clear and urgent need for the availability of / accessibility to accurate data. At the same time, it is not clearly expressed by stakeholders what kind of data is exactly needed, when it is needed or for which specific logistic activity. This means that there are high expectations given to the exchange of data and yet the benefits remain unclear and there is uncertainty about the potential impact.

To make exchange of data between stakeholders easier, it is important to create the right conditions under which it can be realized. One condition for cooperation between stakeholders in the supply chain concerns exchange of data to inform each other and to make smart choices to improve flexibility and reliability of rail freight transport in the supply chain.

First and foremost, this Living Lab will focus on the main measure "Data exchange, data analytics and data use for smart applications in the logistic chain". Three measures were identified by involved stakeholders that reflect their need and interest and fit within the Living Lab approach.

Task 8.3 will focus on:

1) Analysis of performance of rail freight service Rotterdam – Duisburg / Neuss
2) Hub concept terminal Rotterdam for exchange of containers between different rail services
3) Pre-defined paths for short term slot allocation in Germany

From the start and during the course of this Living Lab, each individual measure may possess different types of data or identify the need and possibility to collect data deemed necessary for any kind of improvement.

2.1 Analysis of performance of rail freight service Rotterdam(NL) – Duisburg / Neuss (DE)

Involved stakeholders: (KombiRail Europe, Optimodal, ProRail, Port of Rotterdam)

Conditions for sharing data

The involved stakeholders in this measure each expressed the need and above all interest in exchanging data within the scope of this specific rail service. Next to improving the overall performance of the rail service, it became clear that despite having data themselves, stakeholders were very much interested in the impact of sharing data in this Living Lab. In order to analyze the performance of this rail service, a lot of data (and information) is needed and gathered from the involved stakeholders as described in task 8.2.

To facilitate the process even further and address concerns of confidentiality and disclosure for sharing data, a Non-Disclosure Agreement (NDA) was set up and signed with the involved stakeholders. With this NDA, it is agreed that all the data made available by the stakeholders and subsequent analysis on the performance of the rail service is for the purpose of this measure and stays within the scope of Smart-Rail. Any result or documentation that is asked to be shared by other parties is only possible after agreement by the involved stakeholders. Under these conditions, the main concerns for sharing and analyzing data are addressed and paves the way for implementing measures to improve the performance.

Available data

Among the involved stakeholders, both KombiRail and ProRail have (access to) data that there are willing to share in this Living Lab. As an infrastructure manager, ProRail manages the capacity available and at the same time monitores the trains running on its railway infrastructure. In doing so, ProRail possesses timetable (or planning) data and actual performance data of both passenger and freight trains. For the latter, ProRail uses measuring devices that are physically located alongside the railway infrastructure. With each train that passes, the ID of the train is registered as well as the time it passes, among other things.

Because it concerns data that tells something about the performance of the railway undertaking, ProRail cannot without permission of the railway undertaking share their performance data publicly. With the signed NDA, KombiRail gives ProRail permission to share their performance data only within the context of Smart-Rail.

ProRail is also a member of Rail Net Europe (RNE), the association for infrastructure managers. RNE has developed a tool, called Train Information System (TIS) that gathers the planned time and actual time of rail freight trains within the European Union. This data is provided by the member infrastructure managers of each nation and included in TIS. With TIS, data on past performance of rail freight trains crossing national borders becomes available, including all the intermediate stations.

As a railway undertaking, KombiRail is a paying customer to RNE for which it can use the services of TIS. In addition to this data source, KombiRail manually monitors the punctuality of the shunting processes in the Netherlands and Germany respectively. It compares planned data with the actual data of the train passing.

Based on data sources from ProRail (own data systems) and KombiRail (TIS and own data systems), the following data is available for this measure:

- **Punctuality**:
  - planned time vs. actual time on intermediate stations between marshalling yard Maasvlakte West and Duisburg Ruhrort (40 registration points in total)
  - planned arrival time vs actual arrival time on the terminals and marshalling yards
  - planned departure time vs actual departure time on the terminals and marshalling yards
  - Delay figures (minutes, hours, days)
  - Delay reasons

- **Lead time**:
  - planned lead time vs. actual lead time of the rail service roundtrip (differs per day, depending on number of terminals visited)
  - planned lead time vs. actual lead time between marshalling yards and terminals visited

- **Flexibility**:
  - o number of times the rail service has been executed as planned, rescheduled, rerouted or skipped including the different timeframes in which this took place,
    - Year plan phase
    - Ad-hoc planning phase:
      - up to 36 hours prior to departure)
      - period between 36 hours and 5 minutes prior to departure
    -
  - o weight of the full train (to check if stated weight corresponds with actual weight)

Both for incoming and outgoing trains these items are monitored.

All of the above mentioned data sources and types of data are currently used by KombiRail and ProRail for different purposes. With all this data available it is important that the stakeholders understand it first and agree on its definitions. The data of ProRail and TIS need to be checked and matched in order to identify any differences between them. If differences indeed do exist, stakeholders need to decide which data source serves the common interest best or how they are complementary. At the same time, because different data sources are used, data requires to be integrated in order to be able to analyze the roundtrip of the rail service.

After these tasks have been completed, analysis of the rail service can begin. From that moment onwards, a repetitive cycle of new data from the different sources will commence and repeated until the end of this Living Lab. It is expected that during this period different data needs may emerge or possibilities to integrate existing data with new data are identified.

For example, when looking at the process scheme of the rail service (figure 2-1), the shunting processes in both Germany and the Netherlands are performed by Rheincargo and DB Cargo respectively. Because these processes differ strongly with the line haul process (Maasvlakte West – Duisburg Ruhrort) and offer great opportunities for testing measures, initiatives are underway to have these parties onboard as stakeholders in this Living Lab.

For similar reasons, DB Netz is another interesting stakeholder for this measure.

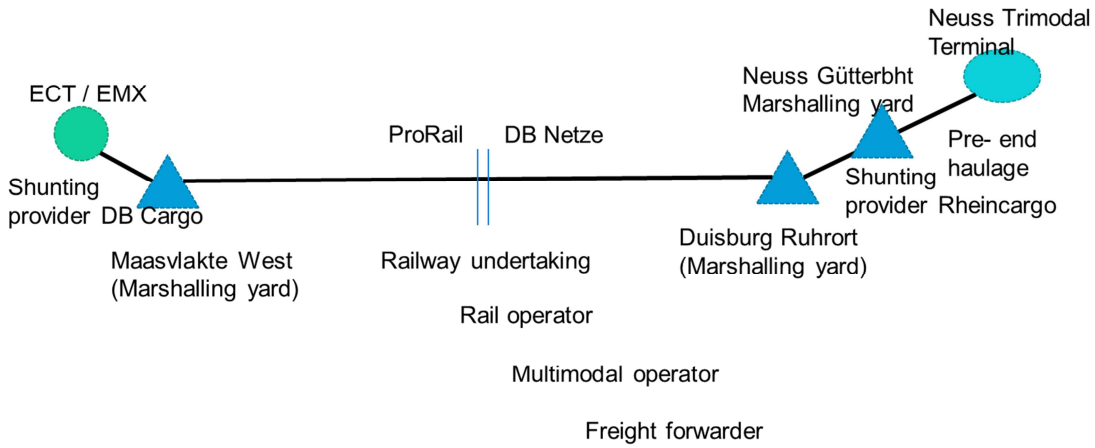

Figure 2-1 Process scheme

For the duration of this Living Lab, the available performance data can be used under different conditions:

- Under normal conditions
- During disruptions
- During the construction phase of the "third track" in Germany
- During issues with rail bundling of containers at the Tweede Maasvlakte in Rotterdam

Expected benefits

The first impact that is expected is the heightened awareness among stakeholders of the possibilities and opportunities of data sharing and integration. The combination of available data allows for a full roundtrip perspective and as such an improved understanding of the role each stakeholder has in the supply chain. At the same time, insight in the different processes of the line haul, last-mile and at the terminal will improve.

Second, the analysis of the rail service will bring focus to areas in the process that require improvement. Patterns may emerge that provide critical information for improving the predictability of the rail service. For example, when the rail service is running late on a particular intermediate station, in many cases it adds two hours to expected time of arrival to the terminal. This provides in turn relevant information for the terminal to optimize its own planning and resources, but more importantly to the shipper who is expecting its cargo on time.

Third, improved decision making. Analysis of data will provide information, which in turn can lead to the decision for developing improvement measures to be tested in this Living Lab.

2.2 Pilot hub concept RTW terminal Rotterdam

Conditions for sharing data

In Task 8.2 it was described that the bundling of containers in the Port of Rotterdam is an area of interest for many stakeholders in rail freight logistics. This has been so for a while and has resulted in studies and documentation focusing on the most efficient and effective way of managing its process and how it should come about. It touched upon topics such as geographical scope, organizational structure, optimization of the container cargo flows and management of costs among other.

For various reasons, very few of these studies have translated into concrete pilots for testing prevailing concepts for bundling containers.

Together with EGS and ECT, this Living Lab will examine whether it is possible to exchange containers between two different rail services at the RTW. It would than serve as a hub for these rail services. EGS is the logistical service provider and at the same time a daughter company of ECT. This provides a safe and concrete environment for testing the hub concept and ultimately the reliability and flexibility of rail freight.

As both stakeholders already share data between each other, there was a particular need for providing the conditions for disclosure and managing the data that is brought into this pilot. An NDA was signed with both ECT and EGS in which it is agreed that all the data made available by the stakeholders and subsequent analysis on the performance of the rail service is for the purpose of this measure and stays within the scope of Smart-Rail. Any result or documentation that is asked to be shared by other parties is only possible after agreement by the involved stakeholders.

Available data

The exchange of containers requires that there is sufficient overlap of time of the two rail services. A first step therefore, is to identify the possibilities for exchanging containers based on the planning of both rail services.

In order to do so, ECT has provided us with a historical data sample (1 September 2015 – 22 March 2016) that contains specific types of data, including:

- Data about all trains arriving and departing from the RTW terminal
  - ETA, ATA, ETD and ATD
  - Composition of the trains: containers and wagons
  - Type of container and carrier

A first analysis of the data sample indicated that based on the planning, both rail services have an overlap of 3,5 hours at the RTW terminal on Friday's.

Further analysis of this data sample will reveal possible bottlenecks for exchanging the containers. The line haul, marshalling yard and terminal processes (see figure 2-2) are very different by nature. To analyze the performance of both rail services running to and from the RTW terminal therefore provides relevant information. At the same time, potential benefits may present themselves out of the first data analysis and are shared and discussed with the stakeholders.

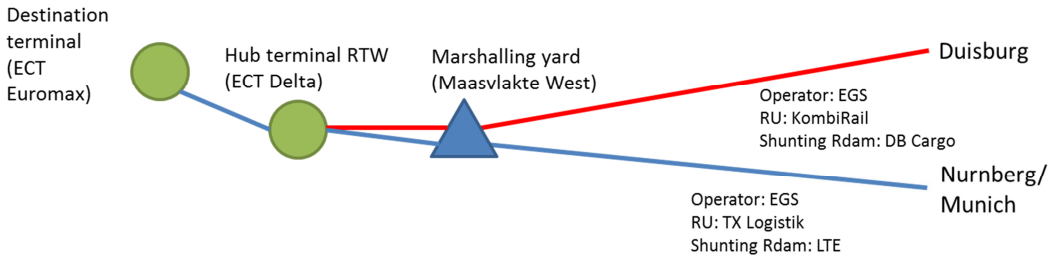

Figure 2-2 Process scheme

For all data that is shared and made available in this Living Lab it is critical to understand it and which definitions are used. Questions may arise concerning the interpretation of data which needs to be addressed.

Expected benefits

By testing this hub concept a number of benefits are expected. The pilot will run for a period of six weeks and its goal is to test the rail bundling concept in practice. Specifically, the reliability of the ETA of both rail services at the marshalling yard and the flexibility of rail as a modality to deal with deviations in the planning is tested. During this pilot, optimization of available rail capacity will be tested as well in deviating circumstances.

This process will gain important insight in the current reliability and flexibility of the rail services and as such the possibilities for exchanging containers. Both EGS and ECT will improve their understanding of the current processes. The tests will reveal (potential) bottlenecks that need to be managed or for which solutions need to be developed. The requirements for exchanging containers at the RTW terminal will be adapted accordingly and tested again.

2.3 Pre-defined paths for short term slot allocation Germany

Conditions for sharing data

The basis to sharing data for this measure will be covered under the NDA signed between Smart-Rail and KombiRail Europe, Optimodal, ProRail, and the Port of Rotterdam. Further to this Deutsche Bahn Netz have indicated that they will be willing to share equivalent data as ProRail as far as is possible without the need for further agreements with Railway undertakings utilizing their infrastructure. Over the course of the project it is intended that the NDA will be extended to include other companies with a wider range of data available for analysis.

Available data

Utilising data obtained in Section 2.1 above, namely data relating to planned and realised train runs between Duisburg and Rotterdam in 2015. A comparison of this data using NEXT methodology (virtual runs) and realised runs would provide a strong indication as to how much the current delays and deviations in the corridor may be reduced with improved IT applications like NEXT. This would give a further indication as to the potential capacity increases and average travel speeds that can be realised when ad-hoc slots are predefined.

The introduction of this tool and the various functionalities are still in discussion and expected to develop over the course of the project.

Expected benefits

The benefits from the introduction of pre-defined paths for short-term slot allocation will be seen by:

- Terminal operators in the form of improved reliability resulting from more accurate information relating to arrival and departure times. This will lead to a better organisation and use of available capacity in the various terminals and the resulting cost reductions resulting from this.
- Railway Undertakings in the form of improved reliability as they will know exactly when the slot is available. This will lead to a better planning of resources and the associated cost reductions relating to these, and an increase in flexibility as it will be easier to respond to ad-hoc requests.
- Infrastructure Managers will see increased capacity on the network, a "simpler" interaction with ProRail, and a reduction in costs.
- More general "system-wide" effects are also expected such as an increase in network speed and system-wide capacity.

3. Conclusion

To some extent, data is already being shared between involved stakeholders to run day to day operations. This, however, differs from stakeholder to stakeholder and more often than not there is no integral sharing of data between all stakeholders over the entire corridor or supply chain. Under the conditions of the signed Non-Disclosure Agreement (NDA), involved stakeholders make different types of data available and accessible that allows for the integration of different data. At the same time, it addresses the first need to understand, analyse and visualize the data for each measure. This is an important step building up towards improving the current performance of the rail service between Rotterdam and Neuss, the testing of the bundling concept between EGS and ECT and for testing the possibility of allocating slots at short term for pre-defined paths.