SMART RAIL

Smart Supply Chain Oriented Rail Freight Services

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Executive summary

The Smart-Rail project, funded by the European Horizon 2020 Programme, explores innovative ways to improve and promote rail freight services from shipper's perspective, i.e. focussing on the market needs and acting on, specifically, five topics: reliability, lead time, costs, flexibility and visibility. To this end, the project adopts an integrated approach, aiming at improving the cooperation overall in the supply chain and within the rail sector, improving the data availability for freight stakeholders, testing sets of measures in three CITs (pilot processes, which test, monitor and improve sets of solutions) and communicating and disseminating its outcomes.

The present deliverable belongs to the "Continuous Improvement Track 2: Control tower for long distance rail freight transport" Work Package (WP7) of the project. This Work Package aims to increase the reliability services both for planned and unplanned disruptions and to increase the visibility of the supply chain. This enables shippers and logistical service providers to make better decisions based on real-time data and to circumvent delays in the supply chain.

In order to realise this goal, WP7 is going to develop a logistic 'control tower' for freight transport on multi-modal corridors including rail links realizing more transparency about alternatives in the multimodal network. WP7 also defines the optimum synchromodal solutions for both supply (infra manager, terminal and rail operator) and demand (shippers, control tower) based on shared data about capacity of infrastructure (rail network and terminals) on tactical planning level. The corridors between Rotterdam and Budapest and between France and Spain will be used to design, implement, validate and improve the control tower concept in this CIT.

However, successful implementation of the control tower concept requires information of and cooperation between different stakeholders such as infrastructure managers, terminal operators, railway operators and logistics service providers. In order to get involvement of participants it is necessary to create awareness about the service, be able to show the potential impact of the control tower concept for their own organisation (benefits, costs, risks, etc.) and to create support for the service from these participants. Quantitative impact of the service has been shown, and different interactive sessions have been organized to discuss about the impact and effort needed for implementation of the control tower concept (including necessary cooperation with other stakeholders).

Table of contents

List of Figures

List of Tables

Definitions & Abbreviations

AC	Alternating Current
BI	Business Intelligence
BOPCOM	Baltic Open Port Communication
BRAVO	Brenner Rail Freight Action Strategy Aimed At Achieving A Sustainable Increase Of Intermodal Transport Volume By Enhancing Quality, Efficiency And System Technologies
CESAR	Co-Operative European System For Advanced Information Redistribution
CIM	Convention internationale concernant le transport des marchandises par chemin de fer
COMETA	Commercial vehicle Electronic and Telematic Architecture
CREAM	Coordinating research in support to application of ecosystem approach to fisheries and management advice in the Mediterranean and black seas

CT	Control Tower
EU	European Union
FLAVIA	FLexible Architecture for Virtualizable future wireless Internet Access
FREIGHTWISE	Management Framework for Intelligent Intermodal Transport
GILDANET	Global Integrated transport Logistic DAtaNETwork
HQ	Headquarter
ICT	Information and Communication Technology
IM	Infrastructure Manager
INFOLOG	Intermodal Information Link for Improved Logistics
IT	Information Technology
KPI	Key Performance Indicator
CIT	Continuous Improvement Track
LSP	Logistic Service Provider
R&I	Research and Innovation
RFID	Radio Frequency Identification
RU	Railway Undertaking
SC	Supply Chain
SITS	Simple Intermodal Tracking and Tracing Solutions
Tx.x	Task x.x
TCO	Total Cost of Ownership
TEN-T	Trans European Transport Network
THEMIS	Thematic Network in Optimising the Management of Intermodal (Freight) Transport Services
TMS	Transportation Management System
TRACAR	Traffic And Cargo supervision system
TRIM	Transport Reference Information Model
WP	Work Package

WIP	Work in Progress

1 Introduction

1.1 Background Smart-Rail

Modal shift from road to rail sector, mentioned in the White Paper on Transport 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 different 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 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 CITs that each focuses on different aspects and markets and develops tools, methodologies and concepts. The purpose of the CIT[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.

WP7 is focused on the development of the CIT2. The CIT covers two long distance intermodal rail connections, namely Rotterdam to Budapest and France to Spain. The routes belong to the TEN-T corridors and are part of rail freight corridor 2: North Sea Mediterranean, rail freight corridor 7: Atlantic and corridor 8: North Sea – Baltic.

Due to the fact that the transport on both routes involves multiple sections, several issues arise. Firstly, a delay on one part of the route can have a significant impact on the transport duration of a container to its final destination. Another issue on both routes is

[1] Shift2Rail is a rail joint 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 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.

the lack of real time information. Small delays on the route, and the lack of real time visibility in case of delays, have a severe impact on the reliability of rail freight for long distance intermodal routes. For products that are time critical or where a reliable delivery time is important often road transport is used. Increasing the visibility, reliability and punctuality of intermodal links greatly affect the attractiveness of the long distance rail product.

Therefore, in order to achieve this there is a need for:

- Increased visibility of the supply chain:
  - Real time information of the status of the network;
  - Insight on the impact of events on total duration from origin to final destination.
- Insight in the best possible alternatives in case of disruptions (decision support):
  - Rerouting transport on particular legs;
  - Reschedule freight flows to different time slots;
  - Shifting transport to other modes for (parts of) the routes.

Implementation of such measures requires data sharing and cooperation amongst different stakeholders such as infrastructure managers, terminal operators, railway operators, and LSPs. In order to provide data to a Control Tower that will support decisions, an information platform will be developed in which real time data of different partners (and third parties) can be accessed in a controllable way. Data owners are always in control of data sharing; data remains in IT systems of these owners unless technical restrictions prevent proper data access by a Control Tower. Data sharing will be used to design, test and implement new measures that increase the attractiveness of the rail freight product.

This will include measures such as:

- Optimizing connections of different legs by bringing slots forward or backward;
- Prediction of transport duration;
- Optimizing routes or modes used.

The aim of this CIT is to provide more and better insight on tactical (e.g. capacity planning) and operational level (e.g. track and trace) so rail transport can stay competitive. In order to do this the following tasks will be elaborated:

- Problem analysis, link with other studies and design of control tower concept;
- Potential impact of the control tower concept and involvement of participants;
- Information exchange required for the control tower concept;
- Alignment of the value case of involved stakeholders;
- Implementation of the control tower concept and design of monitoring approach;
- Monitoring and adjustment of the control tower concept;
- Conclusions and recommendations.

This deliverable will focus mainly in Task 7.2 Potential impact of the control tower concept and involvement of participants.

1.2 Purpose of the document

This Deliverable represents the logical continuation of the Deliverable D7.1. [16], and it reports a summary of findings, conclusions and areas for further research toward the design of an efficient control tower concept. In other words, the research in this Deliverable results in an assessment of the possibility and potentials to include railway transport mode in the whole transport chain managed using the control tower (CT) concept by one of the project partners. Main features of CT implementation, potential barriers, stakeholders and their involvement as well as a quantitative assessment of impact of the control tower concept are presented in this report.

1.3 Structure of the report

The document is organized as follows. Chapter 1 is dedicated to the scope and general objectives of the Smart-Rail project as well as the role and contribution of WP7 in reaching the project objectives. Chapter 2 is the methodological chapter which provides the background for the future scenario of the CT concept, general procedure for involving all parties related to CT process as well as the methodology for organizing interactive sessions with them. Chapter 3 provides a detailed description of the control tower concept, its current state and necessary improvements which are needed in order to maximize the functionality of this concept. Virtual CT as the core solution of the Project is briefly described and the role and importance of CIT2 for improving the rail service (from the aspect of five critical aims of the Project) emphasised. The last three sections of Chapter 3 are devoted to description of the CT process map, data flows as well as to an analysis of the problem, best practices and recommendations that can directly influence on CT concept. Chapter 4 stress the purpose of CT – its benefits, costs, related risks and potential barriers to its full operability. In Chapter 5 some important issues related to creating awareness about the service are discussed. Initiatives of project partners to gain the support for this concept and reactions of the stakeholders are also presented in Chapter 5. The last chapter contains conclusions and recommendations from this analysis.

1.4 Deviations from original DoW

1.4.1 Description of work related to deliverable as given in DoW

D7.2 is the result of Task 7.2. Within this task, the control tower concept, its potential impact as well as the involvement of stakeholders have been analysed. In other words, implementation of the control tower concept requires information of and cooperation between different stakeholders such as infrastructure managers, terminal operators, railway operators and logistics service providers. In order to get involvement of participants it is necessary to create awareness about the service, be able to show the potential impact of the control tower concept for their own organisation (benefits, costs, risks, etc.) and to create support for the service from these participants. A tool will be developed to show all potential participants the quantitative impact of the service and interactive sessions will be organised – in cooperation with WP 10 – to discuss the impact and the effort needed for implementation (including necessary cooperation with other stakeholders). Involved partners such as Seacon Logistics, Port of Rotterdam and ProRail will use their network and contacts with relevant stakeholders, such as rail operators and terminal operators to get them involved in this CIT.

1.4.2 Time deviations from original DoW

All tasks related to this deliverable were fulfilled on time, so there were no time deviations from the original DoW.

1.4.3 Content deviations from original DoW

The activities are conducted within the context of the DoW.

2 Methodology

This chapter details out research methodology for evaluation of the potential impact of the CT concept and involvement of participants. This analysis has to reveals out essential characteristics of the CT concept, its implementation issues, and all initiatives related to a mental shifting of the stakeholders. More precisely, the chapter includes:

- Approach for development and implementation of CT concept;
- Procedure for involvement of stakeholders.

2.1 Approach for concept development and implementation

Control tower concept development and implementation is based on methodological approach presented in D2.3. This section contains a summary of the proposed methodology. The methodology is based on the existing frameworks from previous CITs (such as ENoLL network, CORE, Cassandra, LogiCon), the FESTA methodology and Deming circle.

Cyclical approach lies in foundation of the proposed CIT methodology. Following this approach several solutions can be tested and re-adjusted/improved to fit the needs of the real-life environment. One cycle within a CIT usually consists of the following phases (named differently according to different CIT methodologies):

- **Planning** (sometimes called: Preparation of the CIT; Definition of the CIT; Contextualization; Co-creation; Co-design; Plan) where CIT vision, ambitions, objectives, main users and stakeholders are identified and where implementation cases to be tested in the CIT are conceptually designed.
- **Real life implementation** (or Concept design; Do; Limited and extensive scale field experimentations; Technical prototype development and deployment; Concretization, exploration and experimentation; Implementation; Use) where concrete CIT solutions are prepared for execution and implemented in real life environment.

- **Evaluation** (or Check; Feedback; Analysis) where the results of the implementation are analysed based on more extended data collection and on feedback from the external parties.
- **Act/Decision** (or Conclusion; Technology recommendations) where, based on the lessons learned from the evaluation phase, a decision is made on continuation of the CIT into a new cycle and on what amendments will be made in this new cycle.

A clear understanding and acceptance of different roles, especially within a setting of the railway sector which is characterized by its stakeholder complexity, is crucial for the CIT success. There are at least four main roles that need to be managed within the CIT framework:

- **CIT owner** is a real or virtual organization appointed to lead the whole CIT process and to act on behalf of the CIT. It is suggested to have one or two concrete persons appointed to this role. The CIT owner will take the lead in setting up, organizing, conducting and monitoring the process of the CIT. In Smart-Rail, these roles will be conducted by the respective Work package leaders.

- **CIT stakeholders** is a group of organizations which need to be involved in the organization and implementation of the CIT. Stakeholders are usually involved in the strategic and practical governance and implementation of the CIT.
- **Users** are the organizations, which are involved in testing the proposed innovation or solution in real life. Depending on the solution, users can be organizations as a whole, or a specific group within organizations, for instance planners of a rail operator.
- **Customers** are actors that benefit from the results of the CIT, whether this is a generation of results from trials or implementation of concrete technology or solution.

2.2 Involvement of participants/stakeholders

The following procedure is elaborated to ensure the creation of a stakeholder committee that is truly involved and committed to the activities in the control tower performance. The following points have been useful to approach stakeholders within the control tower concept.

The general procedure has been followed to involve the participants and stakeholders in the process:

1. First of all, an initial list of all the related stakeholders was made.
2. Thereafter, two different groups (1st and 2nd priority or Key Stakeholders and Secondary Stakeholders) were created taking into consideration the level of impact that the Smart-Rail activities could have on the activities of the same as well as the real interest and availability shown by each stakeholder. Therefore:
    a. 1st priority (Key stakeholders – decision makers): This consists on the group of stakeholders really committed with the project and the control tower concept. Organizations and individuals within this group have periodic meetings with Smart-Rail partners and provide relevant information for the CIT in use; they consequently will benefit from the

project results in a direct way and also from all the dissemination actions of the project. Some ideas were provided in order to get participants involvement:

i. The list of 1st priority stakeholders shouldn't be too long. It was worth having a short list of real interested participants that were truly able to commit with the concept.

ii. A preliminary agreement for establishing meetings every one or two months with the stakeholder has been established for each one. The objectives of those meetings are:

   1. Create commitment with the stakeholder;
   2. Promote interest for the project;
   3. Keep informed the stakeholder about the developments of the project.
   4. Get relevant information from them in terms of surveys, interviews, etc.
   5. Achieve the stakeholder's participation in workshops, seminars and other activities related to the performance of the project.

iii. A 1st priority stakeholder may become a 2nd priority throughout the execution of the project and vice versa.

b. 2ndpriority (Secondary stakeholders – affected by decision makers): This consists on the group of stakeholders interested in the project but not contributing directly to periodic meetings and exchange of information as for the 1st priority group. 2nd priority group will receive newsletter and relevant information for dissemination and could eventually participate providing some information. Some particular rules were provided while contacting the 2nd priority group:

i. The list of these stakeholders could be as long as every partner wished.

ii. These stakeholders receive all relevant information from the project by e-mailings but no efforts were made to do a closer follow-up (phone for example). Invitations for meetings were of course also sent out.

iii. A 2nd priority stakeholder could be upgraded to 1st priority throughout the execution of the project is the same showed a specific interest in the activities of the project and committed to the same through meetings.

3. Each partner was expected to provide the name of the company, contact person and position of the same to the general list of stakeholders. The Data Protection Law in some countries doesn't allow sharing specific contact data such as e-mail addresses, phone numbers, etc. Each partner was therefore in charge of managing the contact with its regional and national stakeholders.

4. Each partner was expected to assign one person to manage the contact with its regional/national stakeholders.

2.3 Interactive sessions

The partners involved have organized periodic and interactive sessions with the stakeholders involved in the 1st priority group. The following methodology is used to organize interactive sessions:

1. As first, an email is sent to the contact stakeholder to inform about the Smart-Rail project and specifically about the Control Tower concept;
2. Then, a phone conference is arranged to further clarify the details of the project;
3. After that, the first set of questions has been sent by email. The set of questions differs based on the level of involvement of the stakeholders. Questions are basically in the area of requirements for improving freight logistics services and are related to the concept of control tower (level of interest, knowledge, perception and requirements in case they consider it worthy for their businesses).

The objective of those interactive sessions is to create awareness of the Control Tower concept and also to see the stakeholders' expectations.

This work will be continued in Task 7.4 'Alignment of the value vase of involved stakeholders', since there is a search for opportunities regarding this concept and the aim of looking for opportunities of alignment among the stakeholders involved.

3 Control tower concept and improvement areas

3.1 Background information

A short summary is presented in order to understand the three scenarios for the Control Tower concept. Current activities of the Control Tower concept consist on storing information and forwarding it to the client in real time or on request. To achieve full end-to-end visibility three tasks for the CT are demanded by clients. These involve administrative, management and operational tasks.

Having in mind that the main objective of the CIT 2 is to improve the quality of rail services on intermodal rail connections let's analyse three specific transport chain scenarios related to past, present and future situation [14]. Figure 3-1 presents the main components of the past situation. A typical transport chain was performed by a combination of road, short sea and railway transport mode. More precisely, old scenario consisted of:

- First mile road transport. Picking up freight at origin and transport it to a transhipment point for further short sea operations;
- Short sea operations that involve the transport between European ports;
- Transhipment from ship to train and transport to a hinterland terminal;
- Last mile road transport. Transhipment of goods to a truck and delivery to final destination.

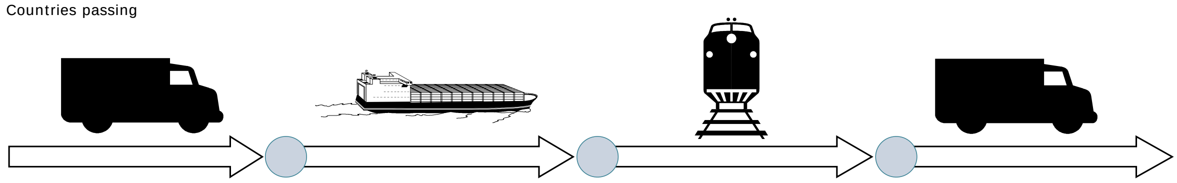

Figure 3-1 Transport chain on a corridor - old situation

- Present situation, evolved from past situation as an incentive focused on a greater share of railway transport in intermodal transport chain includes following phases (Figure 3-2):Picking up freight at origin by road and transport it to a transhipment point for further rail operations;
- Train operations. That involve the passing through different countries;
- Transhipment of goods to a vehicle and delivery to final destination.

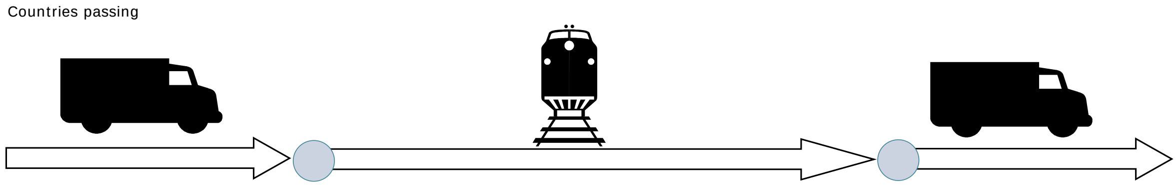

Figure 3-2 Transport chain on a corridor - current situation

Depending on a specific corridor, one possible scenario which will contribute to even more important role of railway transport mode in the whole transport chain may be consisted of following phases (Figure 3-3):

- Picking up freight at origin by road and transport it to a transhipment point for further rail operations;
- Train operation;
- Depended on the final destination, containers will continue using rail or road solutions:
  - Rail transport for long distance delivery;
  - Road transport for short distance delivery.
- Transhipment of goods to road transport and local delivery.

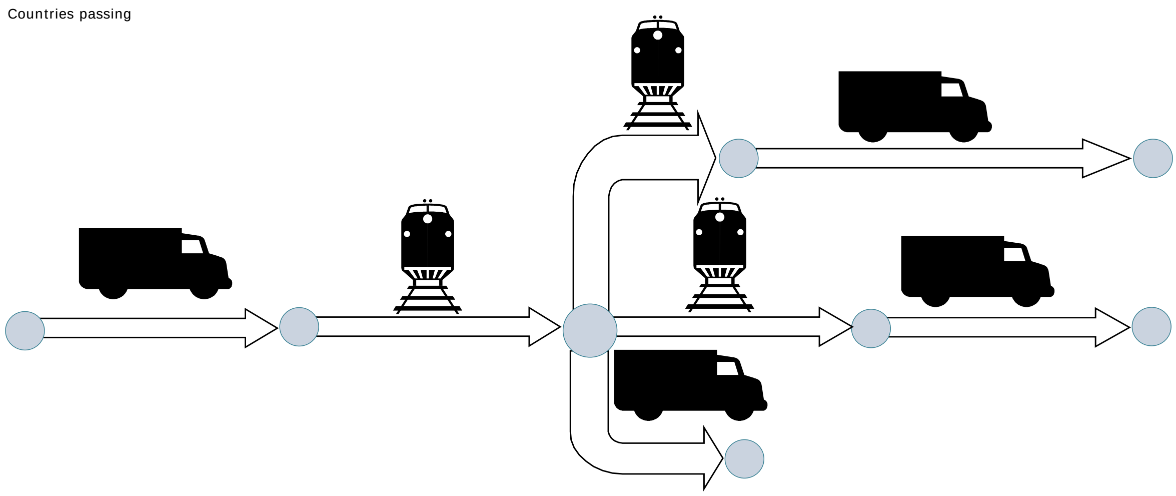

Figure 3-3 Transport chain on a corridor - future situation

This future scenario will imply even higher pressure for transport chain to be more efficient, effective and synchronized. In that sense there is a need to develop a concept that has full visibility based on an increase of shared information and which will be able to propose an optimal delivery for any specific transport request. The solution must be capable to efficiently plan, monitor, and re-optimize (in case of unplanned events in some phase) the flows of shipments on a considered transport network or its part under control.

Therefore, in order to cope with this future scenario and a need for an optimal design of transport chains in presence of various alternatives, CT concept is proposed. One of the main benefits which CT concept will provide is efficient collaboration among the stakeholders and also better customer satisfaction through higher involvement of customers in the whole process through a real time visibility of their orders.

Also. the current CT is focused only on road segment and just one transport leg door to door instead of multiple legs combined. So more stakeholders are involved, must collaborate and must all share more (and faster) information effectively. This implies adding interfaces, checks and balance procedures on shared information, workflow management and agreements and definition of roles, who can do what with the shared information (will be described in D7.5 as well from more practical perspective)

3.2 Control Tower and Continuous Improvement Track description

The focus of this study is the currently available CT (Control Tower) from Seacon Logistics. In this light, the following broad definition of a CT is proposed by Seacon Logistics [13]:

"A department devoted to fulfil the specific needs of (multiple) multimodal client(s) that request full end-to-end (origin to destination) ***visibility*** *of their transport(s) in the supply chain."*

In a CT, the information is stored and forwarded to the client in real time or on request. To achieve full end-to-end visibility three tasks for the CT are demanded by clients. These involve **administrative**, **management** and **operational** tasks.

The current control tower at Seacon Logistics (Figure 3-4) is established to support the shippers' demand for additional transport services. Traditionally in the transportation market, shippers handed the goods to a LSP on point A, a certain time later the cargo arrived on B. The delivery time was/is rather volatile. Nowadays the shipper wants to be informed in a real time fashion and it wants to outsource the logistics since it is not the core business of the shipper and a LSP has a better network resulting in lower logistical costs for the shipper.

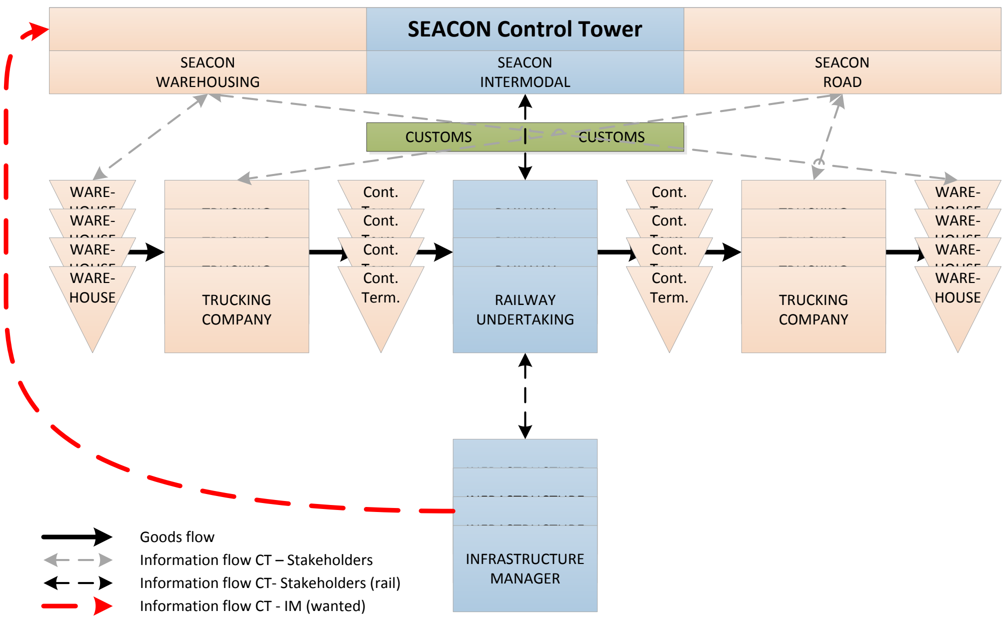

Figure 3-4 CT concept - Seacon Logistics

For Seacon the current control tower covers the information in the following functional areas:

- Arranging transport from A to B (from warehouse on the left hand side to the warehouse on the right hand side for instance) as full service;
- Claim management;
- Financial reporting;
- (Re)planning transport;
- Administration on transport;
- Billing of transport orders;
- Contract management with LSP's;
- Evaluation of the used LSP's, KPI steered;
- Monitoring execution (End-to-end visibility):
- Trucking visibility;
- Client visibility;
- Long-haul invisibility for road.
- Come up with improvement ideas for their logistics;
- Disruption notification to the end client;
- Adapting to new regulations for the end client;
- Communication with external parties on behalf of the end client;
- Plugin for information on the Dutch waterways, e.g. water level.

All these functional areas have its own value and purpose according to the end clients preferences. However, currently some of these functionalities are not so efficient. For example, on the long haul the information needed for monitoring is of poor quality. Barge and rail information is poor compared with tracking information of road. The quality is poor due to two main aspects. The first is the timing is always hours late, furthermore the accuracy of the information received is poor. The frequency of updates is non-conform to the current market environment. As a result LSPs cannot align their supply chain to the fullest nor can it (re)plan proactive.

The information on the execution of the long haul is not the only piece of information Seacon Logistics is missing. What is also not presented in the current setup are real time traffic and transport information.

The contracts involving the CT are typically fragmented into two main groups:

- Group one involves single leg contracts. These are contracts from location A to B, e.g. from shipper to terminal and from terminal to terminal, where in the latter case the terminal can be also a cross dock service.
- The second group are contracts on which multiple legs are outsourced to an external partner. The second group typically uses multimodal transport, e.g. part of the transport by rail sequenced by a short sea movement executed by one contract.

Seacon has strategically chosen their locations throughout Europe, e.g. Venlo, Duisburg, Bremen and Melzo. Seacons' HQ is located in Venlo, which is tri-modal accessible (Road, Rail and Waterways). To utilise this opportunity in a most efficient way (cost and time wise and environmental friendly), Seacon Logistics developed a Control Tower IT tool to manage all transport flows. Unfortunately, regarding railway transport there are still some challenges to be overcome before the Control Tower is able to operate in its fullest potential.

The main issue when looking from the perspective of the LSP is that the rail industry is falling more and more behind in the digital world. For instance, when driving a truck from A to B the driver will get a personal notification that he/she will experience a delay in real time. The rail industry for instance provides a very big file with all their planned disruptions for the upcoming year. So, the truck movements can be monitored in real time and specific, while the rail industry cannot or will not provide real time information and it supplies the needed information in an unstructured way. The main difference is proactive vs reactive.

A LSP wants to be proactive instead of reactive. Therefore, it needs more often, more specific and accurate information from the railway industry. A typical LSP needs this information to inform their clients and to plan their consecutive activities. If information keeps lacking for the upcoming years, as Europe we can stop all rail freight oriented services, because LSPs will not chose rail due to its lacking capability to supply proper digital information in a “digital world”.

The Smart-Rail project suggests a core solution for this problem. The core solution is designed in WP5. In this LL, Seacon Logistics is the practical case in which we can monitor the effect of more and better information sharing from a client's perspective. Since, as end-client oriented partner of the project, Seacon has little impact on the RU and IM. Moreover, for the client it is insignificant what is happening at which party as long as it gets informed proactive so it can react proactively instead of arranging modifications when finding out there was a disruption. Therefore, in this LL the RU and IM are viewed as one.

As proposed in the D2.2 [15], a virtual CT will be made as core solution for the project. In Figure 3-5 the virtual CT is shown as it is the additional input that Seacon is providing in this LL.

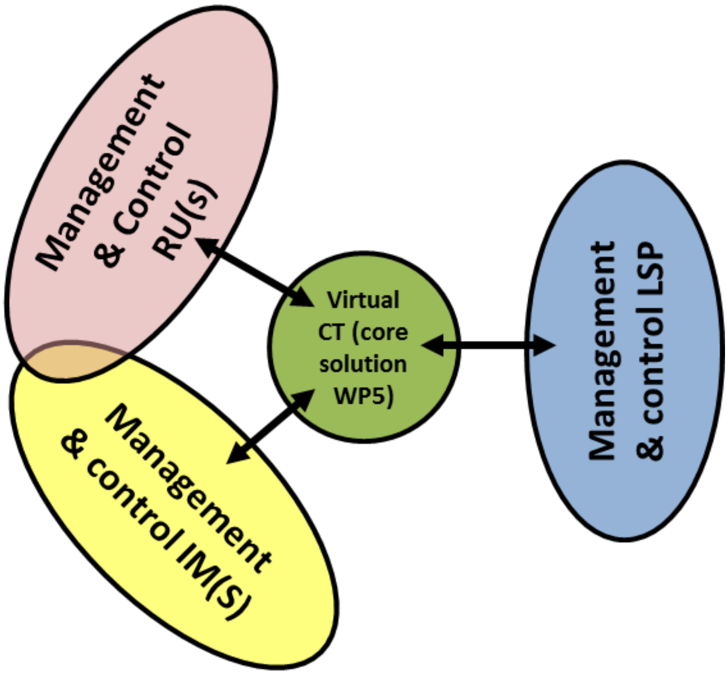

Figure 3-5 Virtual CT as a core solution of the Smart-Rail project

As shown in the Figure 3-5, Seacon Logistics is involved in pulling information out of the core solution of Smart-Rail. The following sections are dedicated to the specific information which Seacon needs to obtain from the virtual rail CT build in WP5. More important for now is that we want to show in the Smart-Rail project that Seacon Logistics is adding information in/to the core solution in the form of client(s), terminal operator and information on the operational execution.

As LSP, Seacon Logistics will make sure it can connect to the core solution of WP5. Seacon provides information on terminals, with approval of the terminals in the network of the CIT. Seacon is providing relevant information on cargo for the rail industry, e.g. weight of cargo, type of commodity etc. Information on the execution by road transportation is forwarded to the core solution, e.g. ETA at terminal in a real time fashion, if supported by the trucking partner. Lastly, Seacon will provide train plans if applicable. In summary, all information up to the transition to rail and information from rail to end customer is intended to be provided by Seacon in the broad sense of information flow.

In this CIT we can monitor the effect of all the information shared among all partners involved in the CIT. We want to show that providing this information in a real time fashion will result in a better rail product. This is due to the fact that the sharing of information enables users of the platform to provide better services to the end client. By better services the following is meant:

- Increased predictability resulting in better management of expectations which on turn contributes to increased **reliability;**
- Increased **visibility** as a result of increased accuracy of the cargo to track;
- Maintained **lead time**. It's a myth that an increased informational flow will lead to a reduced lead time, however the agreed lead time is honoured more often and moreover the lead time to agree with the end client can be given with decreased volatility. The lead time will become more stable as a result of increased predictability;
- The total cost of ownership (TCO) of the service of LSP will decrease due to minimizing mistakes and modifying the plan of actions. Decreased TCO makes it

possible for the LSP to **decrease the cost per transport unit** and offer a more competitive price on rail;

- Being informed more often enables the LSP to get a better grip on their processes and work in progress (WIP). It allows the LSP to approach the current state of the execution close to the reality, **enabling flexibility** on transhipment points[3].

During the efforts to improve the rail service in this CIT in form of better alignment of the SC, the CT is also used to guide the actors in understanding the necessity of guarantying the lead time and its effects. As a primary pillar a focus is set to the volatility of the first/last train mile. Thanks to own GPS on wagon set/locomotive Seacon found that it is primary the last and the first mile of rail transport is causing volatility on the lead time.

The main cause is that the train terminal is lacking communication with the shunting operation. The terminal gives a go signal that the terminal is free for train handling, while the terminal does not know if the parking track is used or not. The parking lot is often used as a buffer for the train to enter the terminal and if the parking track cannot be used a full length trains cannot enter the terminal. We want to use the CT to obtain all the relevant go signals per terminal/shunting operation, so we can address it properly at first. In a later stage in collaboration with rail partners and signals out of the CT we hope we can decrease the volatility on the first and last mile operation of the train.

Smart-Rail deliverable D7.1 [13] provided a brief description of the Control Tower concept and how it should be implemented in this CIT. The Control Tower is a mean to achieve supply chain visibility. Supply chain visibility enables the potential of using (real time) information on three levels of management control [9]:

- Operational (short-term);
- Tactical (mid-term);
- Strategic (long-term).

Although, supply chain visibility is considered to be an important objective to be fulfilled by the Control Tower, it should also be considered that not every leg of the supply chain might be of similar interest for improving the quality of rail freight services. A clear distinction – in Smart-Rail – should be made between supply chain processes/legs that are nice-to-have and need-to-have.

[3] Cargo terminals and country crossings.

Today's Control Towers are often used to support day-to-day business and they include [10]:

1. Decision making tool based on demand and supply;
   - The choice of transportation mode;
   - Optimisation of one or more transport mode(s);
   - Optimisation of the transport routes;
   - Load unit sequence planning.
2. Ex ante - forecasting tool;
   - Predict expected Estimated Time of Arrival;
   - Forecast different relevant factors, e.g. costs, time and change on delay.
3. Event management tool;
   - Alternative route planning in case of disruptions on the network;
   - Inform – if necessary – customers on new route.
4. Ex post evaluation tool;
   - KPI monitoring;
   - Evaluation of the costs and time spend;
   - Evaluation of on time delivery.

Seacon's existing Control Tower [11] is limited to road transport. Integration with other transport modes is essential for seizing the opportunities in intermodal transport. This project focuses on the objective to improve the quality of rail freight services as part of the total supply chain.

The idea is to develop an extension of the current Control Tower IT tool, by means of a specific rail freight service add-on. For this add-on, it was indicated that the data availability for rail transport – compared to road transport – is poor. In order to improve the quality of rail freight services, multiple stakeholder collaboration is necessary.

Based on a quick scan on problems and existing measures/solutions the project team has come up with 4 building blocks that are necessary to be implemented to make the Control Tower to a success (Figure 3-6).

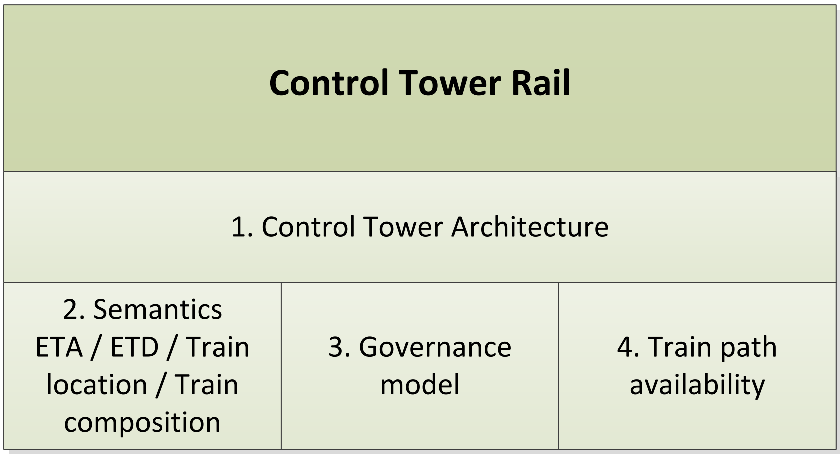

Figure 3-6 Control tower concept - building blocks

3.3 Control tower process map

On base of information obtained from experience of one of the project partners (Seacon Logistics) and interviewing stakeholders, a process map of the CT concept was developed. This process map incorporates CT process activities and represents interrelationships among all CT stakeholders in a future synchromodal transport chain Rotterdam-Budapest corridor and France-Spain corridor (Figures 3-7, 3-8 and 3-9). Presented figures contain general process maps which are based on a corridor between an origin-destination pair of locations.

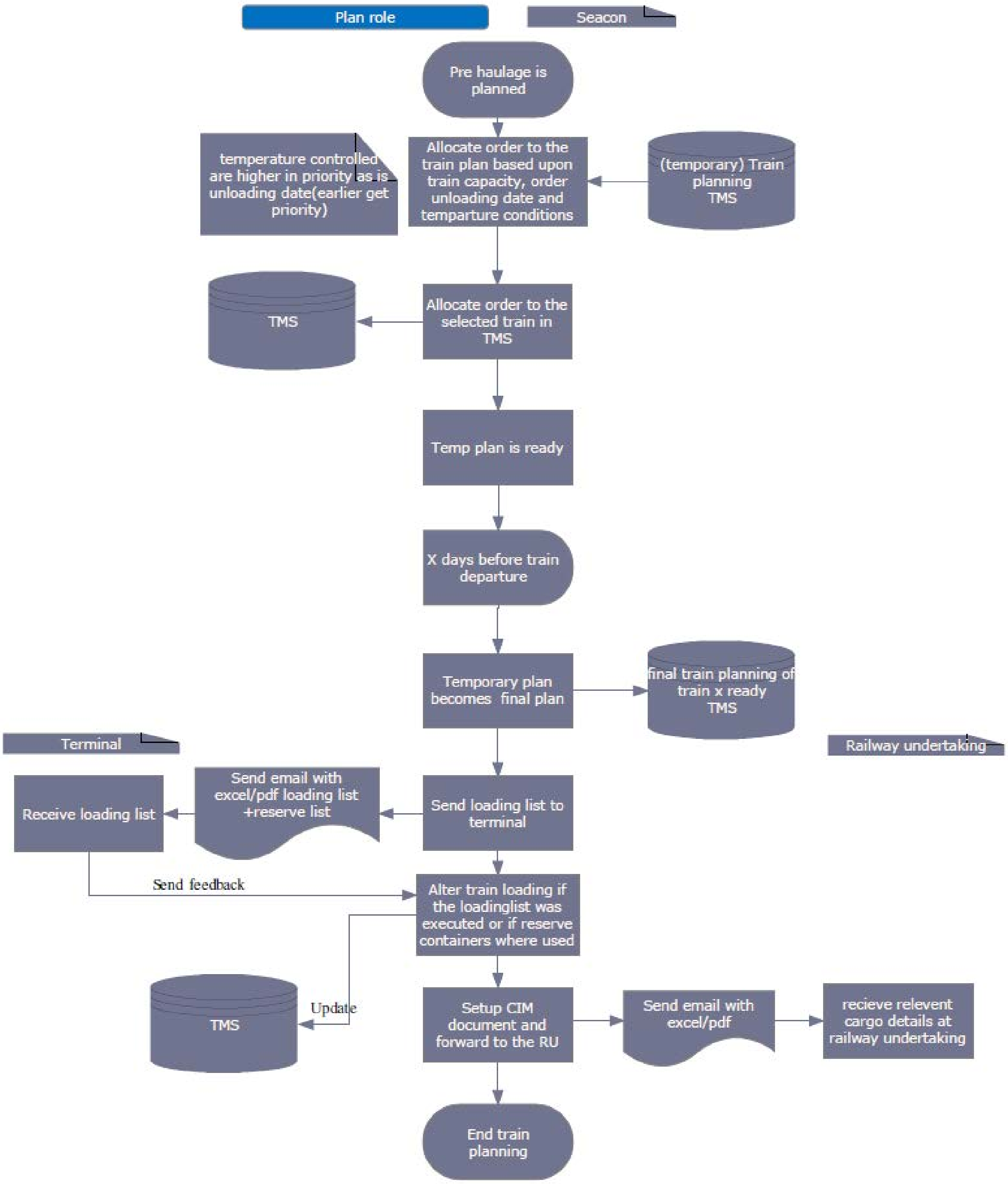

Figure 3-7 CT process map - Origin planning side

As from the map can be seen, for a case of a freight flow with pre- and end haulage included, entire flow of information originated from different sources (terminal, shipper, RU) is described. CT monitors the flow of shipment throughout the whole transport chain and reallocates it on a best way (in accordance to current traffic conditions) in intermediate transhipment points. Therefore, the essence of CT concept is timely, proactive managing of freight flows on different links of a transport route (in this case three branches: consignor-terminal, terminal-terminal, terminal-consignee). According to the process map (Figure 3-7), after the pre-haulage is completed, sufficient train capacity for a given order is booked (in case it is available and other requirements like order unloading date, temperature conditions are satisfied). For this purpose, TMS[4] for efficient multimodal management is used. After the temporary plan of shipment allocation to a train becomes final, the loading list will be sent to a terminal. After the train arrives from a shunting yard, the order will be loaded into it. As it has already explained (Figure 3-5) this process has to be coordinated with the RU (Figure 3-8). A CIM document (Internationally standardized freight document issued in rail transport) is made and forwarded to the RU together with order relevant cargo details.

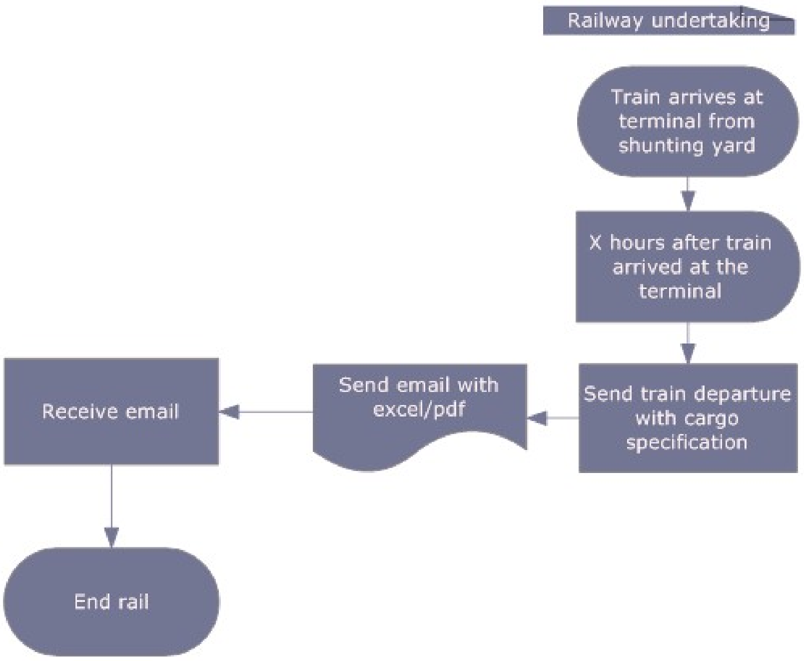

Figure 3-8 CT process map - Coordination with railway undertaking

Prior to the train arrival at the terminal, CT sends the unloading list (Figure 3-9.). In order to realize the end-haulage ride, a delivery slot (dependent on the size of the order, one or more) will be assigned to a client for the specific order (c). The order is then transferred to a truck and delivered to the receiving shipper. At that moment the whole planning & monitoring transport process of a specific order on a route with two interchangeability points is finished.

[4] http://info.kewill.com/rs/kewill/images/Kewill-Transport-4-2015.pdf

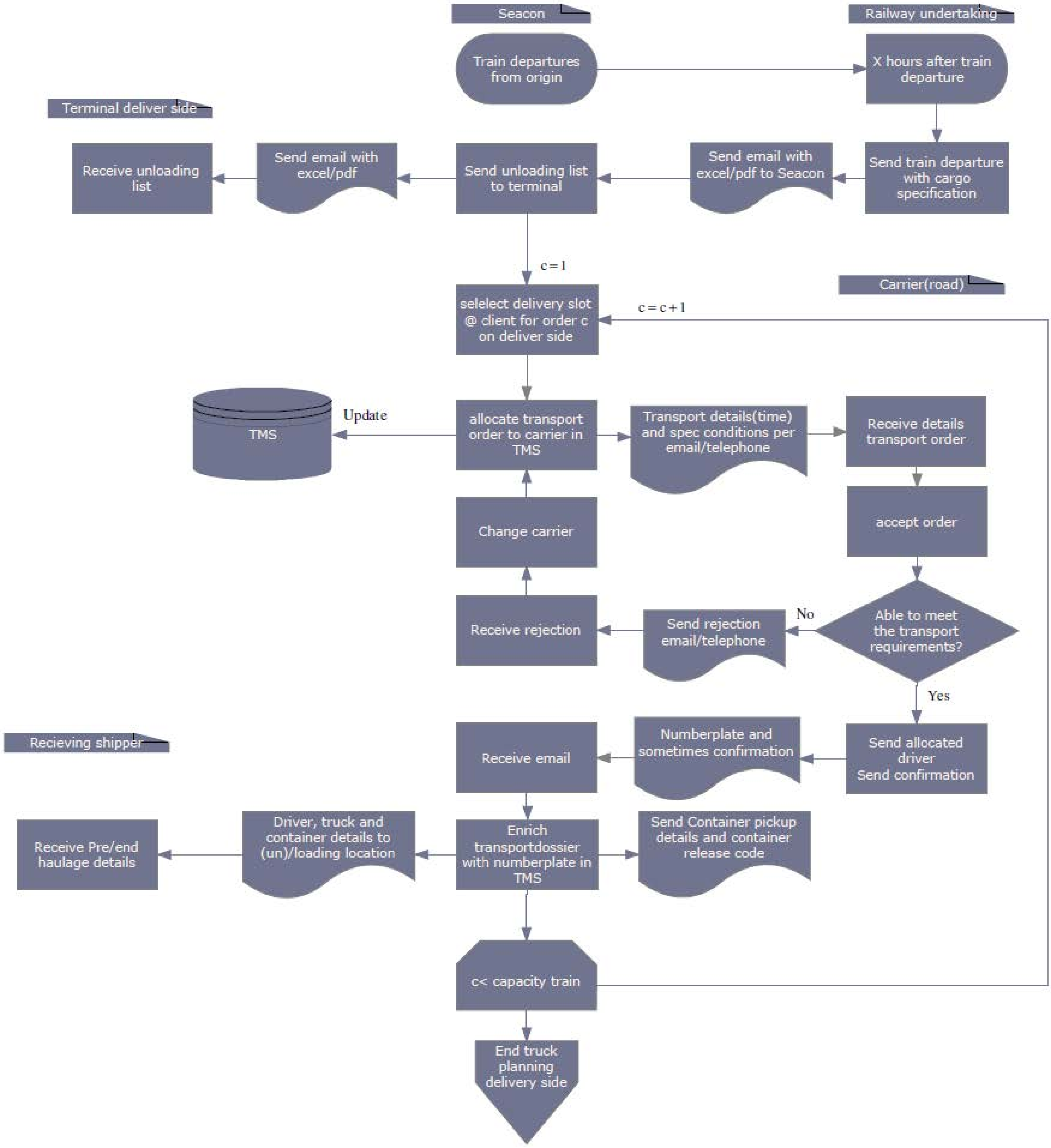

Figure 3-9 CT process map– Destination planning side

3.4 Information exchange required in the Control Tower

From previous process maps data requirements of all stakeholders as well as the flow of information among them can be summarized as follows:

CT requirements:

- Pre-trip information - data and information for planning the train service (in cooperation with the RU), covered often by so-called “reference files”;

- Train path availability for ad hoc planning – in its narrow sense, the train path is available only for the authorised RU; however, for planning purposes, the planning is done in cooperation between RU and LSP;
- Real Time Information – most notably the Train Position; multiple primary information sources are used (e.g. independent ones as GPS units, RFID tags; primary data from the traffic control processes of the IM; fleet management systems of the RU), as described in WP6/D6.1 in more detail;
- Location of the wagons, Track & Trace of individual wagons can be used for prioritisation for loading and unloading trains (e.g. weight, high value products, client request);
- Estimated time of arrival (ETA), Estimated time of departure (ETD) – the key data items for the operative planning.

Between CT → RU

- Pre-trip demand information – demanded train parameters (type of cargo, train estimated/projected train weight and length, special handling);
- Cargo information including train composition;
- Any operative changes in the demanded services.

Between RU → CT

- Train location (now often forced by contract);
- Service availability (lead RU), see also Figure 4-1;
- ETD (from terminal);
- ETA (at the terminal of arrival);
- ATD + ATA (from/at terminal)
- Track & Trace (train and wagon position, in relation to locomotive).

Between IM → RU

- Network statement, reference files and other general info;
- Path request, path study and path availability with the confirmed slot (ad-hoc);
- Train composition and train ready message (from the RU);
- Train position.

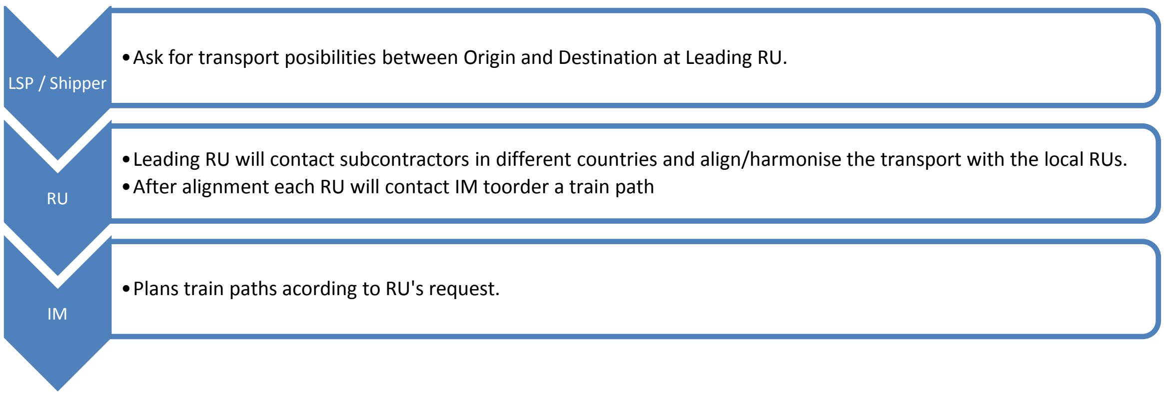

Figure 4-10 Data exchange process

The following data sources were identified:

Rail Net Europe (RNE)

- Country information;
- Corridor information;
- Timetable;
- One Stop Shop;
- Train Information System (TIS);
- Path Coordination system (PCS);
- Charging Information System (CIS);
- Traffic Management & Train performance Management;
- Network Statement implementation guide.

TAF-TSI

- Standard for efficient information interchange. However, still only partly implemented.

DB NETZ

- Lidis system for train positions;
- International train number.

3.5 Review of problem and improvement areas

Part of the information generated in WP2 [14] is summarized below, considering problems, best practices and recommendations that can directly influence over the Control Tower concept and the involvement of participants and stakeholders.

As stated in WP2, supply chain visibility, as a solution based on the improvement of customer visibility, allow the organisation to share valuable information for decision making to improve their performance. The visibility in the supply chain is defined as the scope and depth of the knowledge that any agent has on the various aspects and data related to the management of products. It should provide an overview of the global network that allows easy access to data so they can safely check what is happening at every moment and in every phase of the supply chain. This involves a synergistic collaboration among companies and also public administrations. The solution of supply chain visibility involves the construction of interfaces and visualisation tools, in an open and accessible architecture.

An effective supply chain visibility solution optimises inbound and outbound supply processes by providing near real time visibility of orders, shipments and in-transit inventory across the global trading partner networks. Finally a good supply chain solution can address the complexity of different networks based on three key visibility factors that are essential to provide users with consistent, reliable and timely information: product visibility, process visibility and profit visibility. This solution increases the safety and reliability through the supply chain and flexibility. Some of the effects related to the visibility can lead to security risks and other threats of the supply chain.

Annex A contains a review of EU projects which are directly related to the Supply Chain Visibility concept as well as Control Tower and have also been included in D7.1 [17] as part of the inputs derived from WP2.

Table 3-1 contains some specific problems identified in D2.4 [16] which are related to stakeholders and supply chain visibility as part of the Control Tower concept.

Table 3-1 Problems related to stakeholders and visibility in supply chain

Problems and short descriptions	Aspects associated with this problem	
Information Exchange *The information exchange between supply chain actors should be accompanied by enhanced security measures to ensure reliability in the chain and actor's confidence in it. The information shared in vehicles, cargo and inspection results should lead to trade facilitation, streamlining authorizations from the customs and some degree of predictability in the processes.*	☒Reliability ☒Lead Time ☒Costs	☒Flexibility ☒Visibility
Integration across the supply chain *Unbalanced supply chains do not support integration among actors neither integrated logistic support services.*	☒Reliability ☐Lead Time ☒Costs	☒Flexibility ☒Visibility
Visibility *The lack of valuable information sharing between organisations and also between the actor and the product itself for decision-making to improve their performance in the Supply Chain.*	☐Reliability ☐Lead Time ☐Costs	☒Flexibility ☒Visibility
Interaction with customers		
Track and Trace *Poor tracking of the cargo leads to significant problems. The transport times may be prolonged in an undesirable way, the train or wagon may be misled etc. This way not only inefficiency and higher costs result, but also, due to lower reliability and lack of visibility, the customer may perceive the service as unreliable and he or she may abandon it in the end.*	☒Reliability ☒Lead Time ☒Costs	☒Flexibility ☒Visibility
Interactions between stakeholders		
Standardisation of data *Exchanging data encounters serious problems pertinent to different data formats, their scopes, ranges etc. (data syntax), not mentioning their meaning, involved process area, and level of data detail (data*	☐Reliability ☐Lead Time ☒Costs	☒Flexibility ☒Visibility

Problems and short descriptions	Aspects associated with this problem
semantics).	
Transferability *Development of strategies, methodologies, procedures and systems for a better movement and management of goods in any phase of the supply chain that could be transferable to other phases of the same Supply Chain or different Supply Chains.*	☒Reliability ☒Flexibility ☒Lead Time ☒Visibility ☒Costs

4 Potential impact of the control tower

The main objective of the Smart-Rail CIT 2 is to improve the generic rail product and to prove to the European commission that rail freight is still a freight transport option nowadays and for the future. The proposed solution should result in a win-win situation for all involving partners in the supply chain. By win-win we mean that all stakeholders in the supply chain experience increased benefits from their services. A specific focus of CIT2 is to improve the first/last mile of a train operation as a start. Rather begin small and expand upon this success.

4.1 Benefits, costs, and risks of control tower concept

The main benefit of having a control tower for the end clients is that it can focus on their core business, because it outsources its logistics. More precisely, any client will have available the right and timely information onto one place thus improving visibility (and consequently also reliability). This implies logically that anyone can setup a CT. Setting up a proper logistical department at the shippers site mostly results in less efficient process and less efficient transport options as a result of a limited network. The overall benefits of a CT are stated below and are categorized into five main issue areas:

1. Economies of scale;
2. Control-better alignment of the SC;
3. Utilization of resources;
4. Impact awareness;
5. Enable SC for synchromodal transport.

1. Economies of scale: Due to the bulk purchasing of logistical services for several shippers through a CT concept, economical benefits are obtained. Due to that additional services can be demanded, such as track and trace of cargo or cargo mover.

2. Control - better alignment of the SC: An LSP operating with more accurate and up-to-date information is able to plan his own process more effectively and efficiently. Resulting in an increased punctuality, reliability and decreased costs. Due to the increased punctuality and reliability the transition points of the cargo can be better organised and results into a smoother operation for all parties involved into the transition point. Logically fewer errors in the operation are made and again results into a cost decrease. Also contributing to the cost aspect is the fact that better organisation leads to increased utilisation of resources, e.g. close to a 100% utilisation degree of wagon usage.

3. Less congestion: A logic result of increased utilisation on long haul transport is that less road transport is used, resulting in less congestion on roads. Less congestion on the road allows the pre- and end haulage operations to run smoother and therefore leading to increased punctuality and reliability. On term this lead to less TCO of the supply chain.

4. Impact awareness: A better informed player in a logistical chain is able to be more aware of the impact of his individual decision on the supply chain for his end client and himself. Moreover it can come up with new options given a set of boundaries and be aware of the effect of the options. For example, the allowance of small delays at the departure of a train can lead to big delays further in the supply chain by missing time slots.

5. Enable SC for synchromodal transport: The closer logistical operations come to a state of real time informed, the closer a logistical organiser comes to enabling the full benefits of planning synchromodal (e.g. when the LSP knows that the train is delayed the transport mode for the second leg can changed from barge to truck to limit the impact on the delivery time). Therefore it is stated that information technology can enable synchromodal transport if it provides real time information and on punctual manner.

Considering the cost side of the CT concept, it is clear that transport chain orchestration requires latest technology, advanced software concepts and logistic professionals. These three factors generate the majority of costs for control tower implementation and operation.

Risks of the control tower concept are mainly concentrated around awareness of the service for all related stakeholders. Namely, some stakeholders may show resistance when suggesting a control tower solution due to lack of clarity concerning the safety of their shared information and the control of the operation. As with most centralization efforts some of them will object to losing direct contact in their local language and to having reduced influence in ad hoc problem solving.

4.2 Potential barriers of the proposed measure

The barriers to come to a full operational CT with rail long haul freight transport are fragmented into six main issue areas.

1. Client;
2. Product;
3. Technological;
4. Resources;
5. Cooperative and network (mindset);
6. Politics.

1. Client related issues: Driven by the fact that clients are outsourcing their logistical operations to a 3PL or 4PL. While doing this the client still dictates what needs to happen to the LSP. This is rather contradicting with the definition of outsourcing, which in one of its shortest form is: “Transferring the control of a process or product to a supplier”. In the situation of a LSP it is the end client that is outsourcing its process - the transport – to the LSP. However, in most cases the client is not willing to let go all the control, and still dictates what modality, under what conditions and other. This is also a barrier to the flexibility of the LSP. It would be rather beneficial for the LSP to be able to arrange the transport from A to B as best as it can give an arbitrary point in time. Of course clients need management from their outsourcing partners and if some form of control must be there, it should be a partnership rather than a dictatorship. The client should be got convinced by the LSP by a brand new and high-quality offer of the services, independently on the specific transport mode and dependently just on the quality parameters of the service. It is therefore a sort of win-win cooperation and partnership between both, to allow establishing the new services

2. Product related issues: If one is speaking about products involving long distance rail freight, one must have a rather large stream going from A to B. Not all products are suited for long distance rail freight (e.g. perishable products have the risk of going obsolete during disruptions and are better served by faster modes). According to previous studies the boundary of switching from road to rail should be 300 km (which is also the tie-break distance for setting goals of modal split in the White Paper EU 2011 on the Transport Area). Additionally, products that use uniform loading units are better suited for long haul transport than a product stream that uses several different loading units. Additionally, some products are better suited to the rail transport and the pertinent loading units (as the ISO containers, swap bodies, or even ordinary freight wagons).

3. Technological: Technological incapability's due to complexity of the problem area. A lot of different information sources and partners exist and they need to be aligned in the supply chain in an effective way. All sources have their own characteristics; systems and formats.

4. Resources and risk: High investment costs to start a rail connection. Furthermore the financial risk is currently high as a result of the need to have utilization degree of at least 90%. Building up a proper network for rail freight is rather time and cost intensive.

5. Cooperative and network (mindset): Response time and proactive informing of actors in the supply chain is rather weak. One of the main issues here is that the actors do not know impact of their decisions on the whole supply chain causing problems across the SC. Another important barrier for long distance rail freight transport is the current mindset of the SC directors and is related to the first point made. A Supply Chain director is not aware of the impact of its decisions and as a result of delay on mode, he "hopes" the delay is corrected across the supply chain. Hoping is rather subjective and a form of wishful thinking, a director should know the effect of delay on mode i to mode j (punctuality/reliability) and inform his end client proactive instead of being reactive.

6. Politics: During long haul rail transport it is often the case that politics are rather chosen above the end client of the rail product. By this we mean that different RUs in some cases knowingly and deliberate reduce the speed of its own train so it cannot make it next AC track so another RU or another train of the same RU can take the track which was originally planned for the delayed train.

5 Service awareness and quantitative assessment

5.1 Create awareness about service

The purpose of the CT is to create full end to end visibility in the supply chain for the transport operations of multimodal clients. It involves administrative, management and operational tasks. This concept is expected to be developed by shifting from operational to strategic control tower level. All activities must be supported by available information and proper systems.

The main goal is a more client-oriented approach to be followed. Shippers will be placed on the top of the chain and all partners will receive on all levels available and needed information and the expected result is that rail operations could be better planned and performed from stakeholders' point of view.

In order to achieve the main goals of the CT it is necessary to raise the awareness of the service. The first logical step is identification of stakeholders. They will be split into two main groups:

- Key stakeholders – decision makers;
- Secondary stakeholders – affected by decision makers.

The group of key stakeholders involves stakeholders within the rail sector (rail operators, railway undertakings, rail terminal operators, infrastructure managers, shippers) and logistics service providers and logistics operators. As this is the group of the decision makers, all these will play crucial role for setting up an optimal functioning of the Control Tower. It is very important all stakeholders in this group to be aware of potential benefits, such as:

- Better client-oriented approach;
- Better planning of rail operations in all stakeholders' point of view;
- Receiving real time information and increased visibility of all processes in the supply chain;
- Improvement of lead time accuracy;
- Better collaboration between partners and different modes of transport;
- Directly involvement and participation in the events from origin to final destinations.

To achieve all the above mentioned and to optimize the Control Tower functioning, all the key stakeholders must fulfil a list of important requirements:

- Understanding other stakeholders' needs;
- Understanding the barriers that hinder the cooperation in the supply chain;
- Understanding the impact of solutions on organization;
- Provide input on solution design;
- Implementation of solutions.

The vital role of the key stakeholders' group for successful implementation of the CT concept requires a set of measures to be fulfilled in order to raise awareness among all participants towards the service. Key stakeholders will be reached and contacted by:

- Interviews;
- Surveys;
- Participation in workshops;
- Conference calls;
- Informal meetings;
- Direct participation in solutions;
- Newsletters to disseminate progress to contacted stakeholders;
- Preparation of brochures and other useful materials for the stakeholders;

- Personal meetings – presenting a project summary and explaining the benefits for the stakeholders.

The group of secondary stakeholders will be affected by the decisions taken from the key stakeholders group and because of that they also need to be contacted and involved into the process by:

- Participation in workshops;
- Bilateral talks;
- Preparation of brochures and other useful materials for the stakeholders;
- Presenting a project summary.

Finally, after the assessment and the analysis of the results achieved and based on interviews with involved stakeholders, conclusions and recommendations will be drawn about the most effective methods for creating a control tower concept for long distance rail freight transport services.

Also the most optimal ways for transferring of the CT Concept to other EU Rail Freight Corridors will be considered.

5.2 Quantitative assessment of the potential impact of Control Tower

It is hard to state what the impact is of the CT, as it is a mean to an end. Therefore, elaboration is made on a train level. To show the impact, the process of aligning the supply chain is needed (Figure 5-1). Figures 3-7 and 3-9 show that in parallel to the departure of a train from the terminal, the end haulage is arranged and planned. The planning involves booking slots at the delivery location, setting pickup times for involved trucking parties and allocating time of SC directors. So, given the arrival time of the train plus buffer time for white spots during the train operation a pickup time is forwarded to the trucking parties.

During the whole process no disruptions on train operations are forwarded to the LSP. Now the train does not arrive on time, but is 6 hours late. Normally a buffer time of 3 hours is used. In case of **n** pickups, a waiting penalty must be paid to the truckers by the 3PL/4PL, expressed as the following formula:

$$\boldsymbol{waiting\ costs}(\boldsymbol{n}) = \boldsymbol{waiting\ penalty\ per\ hour}\ \cdot\ \boldsymbol{hours\ late}\ \cdot \boldsymbol{n}$$

So, it means that the train is 6 hours late. This leaves 3 waiting hours for the trucks (after deduction of the buffer time of 3 hours.) If we calculate with an waiting penalty per hour of €100,- the total waiting costs per pickup would be €300,-.

Because the truckers cannot pickup on the agreed time, the agreed delivery time cannot be fulfilled at the client side involving a penalty per transport unit. So the 3PL/4PL get additionally a fine form the customer(s) expressed as:

$$\boldsymbol{customer\ penalty\ costs}(\boldsymbol{n}) = \boldsymbol{n} \cdot \boldsymbol{late\ penalty\ costs}$$

With an agreed late penalty cost of €100,- per hours the customer penalty costs per pickup would be €300.

Normally a 3PL/4PL is informed the train is late by the truckers, because rail is not informing the LSP. The 3PL/4PL knows the train is late once it should be at the terminal. Therefore the 3PL/4PL can start re-planning the slots and trucks after the train should have arrived. This takes additional resources in form of man-hours which can be expressed as:

$$\boldsymbol{additinal\ plan\ costs(n) = n \cdot hourrate\ of\ SC\ director \cdot time\ to\ replan\ transport}$$

Additional plan costs per pick-up of the given example would be €10,- per pickup, calculated with an hour rate of a SC director at €30,- and 20 minutes to re-plan the transport

Part of the replanning time takes the communication between the end customer and the trucking party, therefore for the (re)planning time of a transport a factor of 1.67 is introduced resulting in the following formula:

$$\boldsymbol{additional\ plan\ costs(n) = n \cdot hourrate\ of\ SC\ director \cdot time\ to\ replan\ transport \cdot 1{,}67}$$

In the previous calculation of additional planning costs per pickup in the example we didn't include the additional communication. With all the other factors at the same level the additional plan costs per pickup would be € 16,70

Having stated the three most important cost factors on trains being late, sum the total costs to know the total waste.

$$\boldsymbol{Total\ unnessecary\ additional\ cost\ for\ the\ SC(n) = waiting\ costs(n) + customer\ penalty\ costs(n) + additional\ plan\ costs(n)}$$

All mentioned costs are a form of waste and waste must be eliminated from the process.

To conclude the example calculation, let's say the LSP has 10 loads on the train. This would result in a total extra cost of (300+300+16,70)*10 = € 6.167

With the help of a suitable CT with a rail add-on, at least the waiting costs for the trucks can be eliminated and client penalties can be minimized, resulting in the formula:

$$\boldsymbol{\min_n total\ additional\ costs = customer\ penalty\ costs(n) + additional\ plan\ costs(n)}$$

Those who want to suggest increasing the buffer time are right if they say that will minimize the additional cost, however increasing the buffer time by definition increases the lead time. Increased lead time will result in selecting road over rail so it is not an option.

5.3 Support for the service

Different meetings have been organized as a result of the selection of the 1st priority group. As a summary Seacon and ZLC are in direct contact with several stakeholders as can be seen below that will actively participate in the value case methodology proposed in Task 7.4:

Table 5-1 Support from the stakeholders

Seacon	**ZLC**
Company 1 (terminal operator in Luxembourg/France): Invited to become a stakeholder. Acceptance to participate. Next meeting	Company 7 (inframanager Spain): Invited to become a stakeholder. Acceptance to participate. Next

scheduled	meeting scheduled
Company 2 (terminal operator and trucker in UK): Invited to become a stakeholder. Acceptance to participate. Next meeting scheduled	Company 8 (Chamber of commerce Spain): Invited to become a stakeholder. Acceptance to participate. Next meeting scheduled
Company 3 (railway undertaking Italy): Invited to become a stakeholder. Next meeting scheduled	Company 9 (inframanager Spain): Invited to become a stakeholder. Acceptance to participate. Next meeting scheduled
Company 4 (railway undertaking UK-Eurotunnel-France): Invited to become a stakeholder. Next meeting scheduled	Company 10 (trucker and intermodal transport): Invited to become a stakeholder.
Company 5 (railway undertaking France): Invited to become a stakeholder. Next meeting scheduled	
Company 6 (inframanager Netherlands): Invited to become a stakeholder. Acceptance to participate. Next meeting scheduled Company 7 (Trucking companies in France/Spain): Invited to become a stakeholder. Acceptance to participate. Next meeting scheduled	

5.4 Inform about benefits and added value for stakeholders

The aim of this section is to inform about requirements from stakeholders: what will be credible and useful, contribution, facilitation of quality data collection, help to make sense the data, increase capacity building and support for evaluation.

Some of the comments and information provided by the stakeholders are summarized here. Part of the information that was requested based on stakeholders' requirements and shippers' point of view:

- From the shippers' prospective the IM analyses five parameters:
  - **Reliability:** The shipper wants to be fully reliable with the transport, in terms of perfect conditions of security, without errors. For the shippers this is crucial for their internal planning. Trains scheduled to departure one day at a particular time will departure. Their point of view is that at least in Spain this is achieved. Punctuality is over 95%. Agreements of Concerted Quality support them.
  - **Lead time:** Shipper needs, upon to arrival to the destination, an

immediate manipulation, which is achieved. If they send a train to a particular destination, delivery is immediate since they have own locomotive means. If the delivery includes container on a truck, they can do it in a maximum of 90 minutes.
    - **Costs:** Shippers want a minimum price. The infra manager thinks they do it as such. Canons they pay are reduced to promote these traffics.
    - **Flexibility:** For the shipper, it has to be possible to change schedules, lengths, freight, wagons, etc. in an immediate way. In this area, the IM is quite slow, better than in the past but not enough.
    - **Visibility:** As shippers, they want to know exactly where the freight is. The inframanager has not their own tools to facilitate trace and traceability of transport to the customer. Each railway company has its own system. The IM still hasn't got an integrated tool for this issue. This issue becomes more important during disruptions. At such an event the shipper wants to know the new ETA to adjust his internal planning.
- From the experience of international traffic, they ensure that it's quite complicated to consolidate in multi-client trains. The multi-client trains with a big company afterwards, can provide then the perfect formula: Trains with freight in both directions. Main difficulties are still to achieve freight in the back haul at international level. One of the solutions to palliate this problem is the creation of trade trains, which mission is to fulfil freight trains.

6 Conclusions and recommendations

The term "Control Tower" is being used in many supply chain circles to describe an end-to-end holistic view of the supply chain and near real time information and decision making. The essence of the control tower concept is to provide supply chain visibility across divisions, countries and modalities. The heart of the control tower is an information hub supported by a set of detailed decision-making rules and a trained team of operators. The big advantage of this central information hub is that it gathers and integrates data from a variety of sources and subsequently distributes it in a consistent format. This integrated overview allows the control tower operator to detect risks or opportunities at an earlier stage.

This deliverable reveals the control tower concept and its impact on various stakeholders within the supply chain. The focus is on concept usability from the aspect of increasing the efficiency and therefore, the share of rail leg in the whole supply chain. In order to get these answers, information of and cooperation between different stakeholders in the transport chain is needed. In order to get involvement of participants it is necessary to create awareness about the service, be able to show the potential impact of the control tower concept for their own organisation (benefits, costs, risks, etc.) and to create support for the service from these participants. Deliverable contains a quantitative analysis of quantitative impact of the service and also different interactive sessions have been organized to discuss the impact and the effort needed for implementation (including necessary cooperation with other stakeholders).

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Annex A

This Annex contains a review of projects which are directly related to the Supply Chain Visibility Control Tower concept.

CREAM project

The CREAM project [5] – executed under the sixth Framework Programme for Research and Technological Development – consists of the following elements:

- Analyse the market requirements for typical supply chains along the entire corridor – or parts of it – and derive a coherent set of templates on innovative rail freight services appropriate to tap the full potential of modal shift towards rail;
- Define advanced business models for setting up integrated, road competitive rail freight service offers, thereby considering EU plans of establishing a single European Railway Area and incorporating the experiences of new entrant railways and other transport mode operators on cooperation in international rail freight transport;
- Develop a coherent quality management system (QMS) and implement the necessary structural and organisational measures to ensure the monitoring of the most important quality criteria such as punctuality and reliability and the identification of necessary process improvements;
- Outline corridor-specific train operation concepts able to absorb and bundle sufficient quantities of cargoes and to exploit the given resources in the most (cost) efficient way;
- Implement interoperability and improved border crossing procedures – thereby making use of multi-system locomotives (MSL) and joint border crossing operating centres wherever appropriate;
- Set-up integrated telematics solutions taking up the expanded infrastructure managers' information systems and supplementing them on corridor sections – mostly in Southeast Europe – by satellite-based (GPS) tracking and tracing systems;
- Analyse particular markets of temperature controlled cargo logistics and transport of semi-trailers in order to provide technical-operational concepts that allow facilitating the modal shift of the still road-dominated transport to intermodal road-rail transport.

BRAVO project

The following activities were developed under the BRAVO project [2]:

- Development of a coherent Brenner corridor management scheme which shall meet the requirements as a sustainable system – maintained beyond the project period - and an open system enabling the access of new entrants;
- Development of an improved train path availability and allocation process;
- Development of an interoperable rail traction scheme involving the employment of multi-current locomotives;
- Development of an EDP-supported corridor quality management system (QMS) including quality agreements;
- Development of an advanced customer information system (CIS) generating an „estimated time of availability (ETA)" information in the event of delays based on the development of a real-time train location system;
- Elaboration of a time-schedule (short-, medium- and long-term perspectives) for extending intermodal transport services, e.g. to Southern Italy and Greece;
- Development of a self-sustained intermodal technology to capture the growing market of conventional road-only semi-trailers for intermodal transport.

FLAVIA project

The FLAVIA project [7] improves the intermodal transport along the corridor Central/Southeast Europe, using a logistics-oriented approach. Objectives were facilitating the transport of goods, improving prospects of access to markets, economic development and growth and reducing existing disparities of regions.

The project focused on intermodal transport but was also open for multimodal approaches. However the efficient use of inter- and multimodal transport depends not only on network conditions. Market players have sometimes mental barriers which to overcome is very important. Consequently FLAVIA aimed on establishing national pro-rail alliances and a terminal alliance to promote and develop future inter-/multimodal transport.

Improving logistic channels among the involved regions will contribute to the integration of markets of the enlarged European Union. To overcome existing bottlenecks and gaps in the intermodal infrastructure FLAVIA analysed options to reduce organisational and administrative obstacles of integrated logistic chains. Concrete action plans for the removal of bottlenecks were elaborated and new intermodal concepts (rail, inland waterway, terminal development) developed with the help of pre-feasibility studies.

After promoting the concept of a pro-rail alliance during the project the establishment of three pro-rail alliances was accomplished. According to the already existing model in Germany, new alliances were set up in Poland, Austria and Romania. In all three countries memorandum of understandings were signed by profit and non-profit organisations. The alliances will communicate the needs of the railway sector towards the policy decision makers and the public.

In addition to this, over the course of the project the idea of a terminal alliance was discussed and an initial group with terminal representatives from Germany, Hungary and Romania was formed. The terminal alliance shall be used as a platform in order to implement common actions and interests like staff educating, marketing or business development.

Within FLAVIA numerous pre-feasibility studies have been finalised, dealing with the topics terminal development, railway services, green logistics and inland waterway transport. Furthermore, the partnership released in total eight best practice brochures "From truck to train". In addition an IT routing tool has been further developed. It enables the user to route intermodal transports through Europe. Together with the intermodal wiki both tools shall help to raise the awareness for intermodal transports. The wiki provides a knowledge base for intermodal transport topics.

Besides all of the projects mentioned above and included in D7.1, there are a lot of projects considering the visibility issue in intermodal transport chains:

BOPCOM project

BOPCOM project [1] represents an open platform in the Baltic sea and comparable areas for co-operation in telematics and logistics of small and medium ports concerning the application fields of cargo booking, dangerous goods, vessel movement, combined freight traffic terminal, localization of units, customs cooperation, statistics, berth allocation, hinterland transport. It covers following areas:

- Interconnectivity of individual systems of e.g. single users, companies, authorities and local or regional communities (called Lopcom);
- Confidential handling of information controlled by the individual users;
- Common data handling so far as reasonable e.g. concerning dictionaries, vessel information, dangerous goods, statistics, etc;
- Interconnectivity of different technical und organizational standards and networking services;
- Establishment of services and consultancy in adaptation or development of individual systems in local areas as well as dissemination of existing and new solutions to all parties interested in the solutions.

CESAR project

The objective of CESAR project [3] is the improvement of intermodal transport performances and quality, with a further view to attracting more transport volume for intermodal transport and increasing efficiency of transport in the European Union. This quality improvement can be obtained by the intermodal transport information system. The basis of a common standard interface for information and data exchange and distribution between combined transport operators and their clients is planned to be established by CESAR project. It is planned that as a kernel of such a European standard information system, major operators of the two main alpine North-South routes in Europe link their information systems, as far as operator - to – client information flow is concerned, and develop, in close conjunction with the other actors in European intermodal transport, a basis for standard communication for this type of information flow and interaction. A cooperative approach is used in order to enable the initial three partners to increase the performance of their different information systems while still allowing them to keep their decentralized structure. Tests are performed on Gotthard and Brenner axis and a co-ordination and acceptance procedure with the other actors in European intermodal transport.

COMETA project

The COMETA project [4] has been initiated to answer the concerns about introducing new ICTs by defining and designing modular associations of various on-board functions based on clear interfaces with the global transport environment. Namely, the introduction of new information and communication technologies will affect on the kind of tasks assigned to drivers and dispatchers and this will make some problems of interoperability, problems of ergonomics and spiralling costs. The main objective of COMETA was to develop a modular system architecture for on-board freight, fleet and cargo management systems based on clear interfaces that can be standardized. Having explored and identified the possibility of integrating all on-board elements related to the driver/operator function through an open data interchange system, COMETA has also taken the results of other relevant projects like KAREN (overall system architecture), FLEETMAP (standardizing the communication between home base and vehicle) and national projects concerning mobile EDI into account.

FREIGHTWISE project

The objective of the FREIGHTWISE project [6] was to serve as a base for defining future strategies for developing the intelligent intermodal freight transport solutions. The idea for FREIGHTWISE research project was to lead to the production of a virtual transport network and a stakeholder framework that will provide a blueprint for managing the interaction between co-operating organizations region wide. The virtual transport network allows users to assess the available transport services for a specific transport chain by running the relevant operational and commercial information through FREIGHTWISE. This facilitates the integration of transport services across Europe and fosters closer co-operation among stakeholders while preserving commercial integrity and confidentiality requirements. The stakeholder framework takes the principle of co-operation even further by setting out business guidelines to support the management of intermodal transport chains across the range of companies and institutional actors (e.g., customs or port authorities) involved. This stakeholder framework facilitates the definition of contractual terms and liabilities and appropriate information management processes such as reporting rules or confidentiality and security aspects. Another output was integrated reference architecture to support the modelling of business processes and information flows and facilitate the design of interoperable transport management systems. The conceptual work in FREIGHTWISE was strongly informed by nine FREIGHTWISE business cases covering various transport scenarios and geographic areas.

GILDANET project

The main objectives of the GILDANET project [8] were related to enhance existing ICT-solutions with capabilities to cooperatively support transnational transport chains. More precisely, efforts are made to build upon the recommendations and deliverables of international standardization bodies such as UN/CEFACT, OASIS and ebXML. The project built pilot systems, interconnecting ICT-solutions among themselves and with legacy applications of other public/private actors (e.g. Custom, public administrations, companies) to support specific transport chains, such as perishable goods, automotive and reversed logistics of container. Moreover, a specific attention has been paid to define appropriate business models and to establish a level playing field for SME‘s and global players.

INFOLOG project

The goal to be achieved by INFOLOG [12] is to demonstrate how the efficiency of intermodal transport based on waterborne, road and rail transport as a core can be improved through better information and communication possibilities. Hence INFOLOG addresses one of the most critical issues for successful intermodal transport chains. Better means of generating and accessing information is the key to achieving the necessary amount of control and flexibility needed to compete with door-to-door transport by truck. The project set out to meet the objective by developing a Transport Chain Management System (TCMS) based on concrete requirements from shippers, forwarders, shipping agents, carriers and terminal operators/ports. The TCMS has been designed with a modular structure making it generic enough to be used from supervision of simple transport services to automatic message handling in complex logistics solutions. The TCMS makes it possible to adapt step-by-step the handling of more difficult transport chains with an increasing number of players, restrictions and options, thus easily responding to actual needs and to a growing understanding of the possibilities of using modern information technology in intermodal freight transport solutions.

SITS project

According to the scope and objectives of the SITS project [13], the main focus of the work was therefore to “propose a concept for an inexpensive, user friendly, cargo Tracking and Tracing solution that is applicable at National and International level and focused on shippers needs”. Besides this overall objective, SITS was to investigate a number of other secondary issues, which can be summarized as follows:

- Illustrate the opportunities for integration of TRACINGAND TRACKING solutions in the operation of Freight Transport with emphasis on intermodal transport;
- Devise a generic and commonly agreed Framework to include T&T information in today's transport information systems;
- Fill in possible gaps, especially on technical and organisational interfaces;
- Clarify and illustrate the pros and cons of the solutions and perform a comprehensive evaluation of a potential European wide T&T system;
- Develop implementation strategies by assessing critical success factors;
- Demonstrate a viable Tracing and Tracking solution; and
- Make recommendations for public or collective (public private partnership) actions to remove barriers and/or stimulate the development of T & T solutions.

THEMIS project

THEMIS' area of work has been defined as the planning and operational functions of freight transport within the future European ITS [18]. THEMIS will attempt to define the position of European Freight Transport within the Intelligent Transport Systems (ITS) infrastructure that is being developed, by utilising technologies and applying innovative logistics concepts in order to contribute to a rebalancing and integration of the different transport modes into intermodal transport chains. Of the various ITS applications and areas of development, THEMIS is focusing, by way of priority, into the relation and integration of the new, ITS-based, Traffic Management Systems (TMS) with the Freight Transport Management systems operation (FTMS). From 2001 to autumn 2004, the task of promoting the Framework Architecture and providing practical assistance to users was carried out by FRAME-NET and FRAME-S. They provided various forms of support: a) seminars and training workshops; b) international meetings and events, c) brochures, reports and technical documents. The FRAME projects (FRamework Architecture Made for Europe) were funded by the European Commission as part of the 5th Framework Programme of the Information Society Technologies (IST) Directorate. They were a follow-on to the KAREN project (1998-2000) which developed the first version of the European ITS Framework Architecture Thematic Network on Intelligent freight Transport Systems (http://www.frame-online.net).

TRACAR project

The overall objective of the TRACAR project [19] is to establish a common telematics system/standard for the identification, positioning and management of cargo in a multi-modal set up (cargo in terminals, on road, railway, sea and inland waterways), including the handling of freight documents. The project builds on existing, but upgraded, low frequency /Transponder technology and other established technologies i.e. radio-, tele-, and satellite technology. These technologies will become integrated and enhanced. The development of the system should lead to an attractive low-cost system, which should bring cargo back to the railways (with all the advantages this implies), become attractive for the SME user group and increase the EU's competitiveness in the world market for cargo transport.

TRIM project

The establishment of TRIM is a step towards improving the information flows in multimodal freight transport [20]. The lack of integration between the information systems along the transport chain causes many problems and extra costs, and there exists a large potential for improving the present situation. Current information systems in the transport chain cannot communicate with each other because of lack of a common "language". TRIM will improve this situation by defining a common language, which can be implemented as standard messages between the information systems. Better communication between the information systems will increase the reuse of data. Practical experiences have shown that each information element is manually controlled and registered about 12 times for a typical transport. Reuse of data can result in large benefits. Data should only be registered once, and should be reused by all actors which need this data. TRIM is based on the data needs from several European Union projects in the freight transport sector, and is recently supported by the D2D project. TRIM is also supported and adopted by ARKTRANS, the Norwegian system framework architecture for multimodal freight and passenger transport. Physical Data Models and schemas for most of the popular DBMS´s can be generated on request. The scope of TRIM includes the information needs for all actors along the transport chain, from consignor to consignee. The transport chain covers international freight transport by road, waterway and railway.