SEVENTH FRAMEWORK PROGRAMME

THEME [7]

Theme Title: Transport (including Aeronautics)

SuperGreen

SUPPORTING EU'S FREIGHT TRANSPORT LOGISTICS ACTION PLAN ON GREEN CORRIDORS ISSUES

Grant agreement for: <Coordination and Support Actions (coordination)>

Grant agreement no.: TREN/FP7TR/233573/"SUPERGREEN"

Deliverable D4.2
Define application areas for smart ICT

Version 2

Due date of deliverable: 15 January 2013

Actual submission date: 3 December 2012
Revised deliverable submission date (1st revision): 18 February 2013
Revised deliverable submission date (2nd revision): 25 March 2013

Organisation name of lead partner for this deliverable: NTUA

Document ID number: **04-20-RD-2013-01-01-3**

REVISIONS/DOCUMENT HISTORY:

Index	Date	Authors	Reviewers	Subject
0	15/10/2012	P Zacharioudakis et al	H. Psaraftis	Internal review
1	15/10/2012	P Zacharioudakis et al	Sanni Rönkkö H. Psaraftis	Internal review
2 3	18/02/2013 25/03/2013	P Zacharioudakis et al P Zacharioudakis et al	H. Psaraftis H. Psaraftis	External review External review

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Classification: **R** Confidential (CO)

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Revision history

Rev.	Who	Date	Comment
0	All	15/10/2012	draft
1	All	01/12/2012	final
2	All	18/02/2013	revised
3	All	25/03/2013	2nd revision

Quality Control

	Name	Date
Checked by WP leader	H. N. Psaraftis	2012-12-01
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APPROVAL:

All partners of the project consortium via a return email have approved the final version of this SuperGreen Deliverable.

ACKNOWLEDGMENT

Funding for the SuperGreen project has been provided by the European Commission (DG-MOVE) and by partners' own funds, in the context of Grant Agreement No. TREN/FP7TR/233573/"SUPERGREEN".

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List of Abbreviations

ACC	Adaptive cruise control
AIS	Automatic Identification System
AMV	Verkehrsmanagement Audio Mobil
ATP	automatic train protection system
BAS	Braking Assistant Systems
C2C-C	CAR-2-CAR Communication Consortium
CATOS	Computer Automated Terminal Operation System
CBTC	Communication Based Train Control
CHD	charges and harbour dues
CITIS	Container Terminal Information System
CITOS	Computer Integrated Terminal Operations System
CO	Carbon monoxide
CO_2	Carbon dioxide
CTA	Container Terminal Administration
CTCS	Container Terminal Control System
Dow	Description of Work
DVB	Digital Video Broadcasting
ECDIS	Electronic Chart Display and Information System
EEZ	Economic Exclusive Zone
EGNOS	European Geostationary Overlay System FDMA Frequency-division multiple access
EIRAC	European Intermodal Research Advisory Council
EIS	Executive Information System
EM4T	energy meter
EMDM	European Maritime Data Management
EOBT	Estimated Off Block Time
EONBT	Estimated on block time
EPS	Eumesat Polar Systems
ERI	Electronic Ship Reporting in Inland Navigation
ERTMS	European Rail Traffic Management System
EU	European Union
FIS	Fairway Information Services
FTMS	Freeway Traffic Management Systems
GIS	Geografical Information System
GPS	Global Positioning System
GSM	Groupe Spécial Mobile
GSM-R	Global System for Mobile Communications - Railway
GSM-R	Railway Communication
GUI	Graphical User Interface
Ibnet	icebreakernet
ICT	Information and Communication Technology
IDSC	Integrated Decision Support Corporation
ISA	Intelligent Speed Adaption
ITS	Intelligent Transport Systems
IWT	Inland Waterway Transport
KPI	Key Performance Indicator
LDW	Lane Departure Warning
LRIT	Long Range Identification and Tracking
MACH	Marine Container Handling system
Marnis	Information Management for Maritime Safety Security & Environmental Risk Management
Nox	Nitrogen oxides (NO and NO2)
PCS	Port Community System

PRA	Property Registration Authority
PTM	Port and Terminal Management
RFID	Radio Frequency Identification
RIS	River Information Services
RNE	railneteurope
S-AIS	Satellite-based Automatic Identification System
Sox	Sulphur oxides (SO_2 and SO_3)
SSN	safeseanet
SSS	Short Sea Shipping
STI	Strategic Traffic Image
SW	Single Window
TAF TSI	Technical Specifications for Interoperability for Telematics Applications for Freight
TIS	Train information System
TPM	Train Performance Management
VHF	Very High Frequency
VIB	Bavaria's new traffic information agency
VTMIS	Vessel traffic service
VTS	Vessel Tracking Services

Executive Summary

SuperGreen is a project that aims to promote the development of European freight transport logistics in an environmentally friendly manner. Among other tasks, SuperGreen evaluates a series of corridors covering some representative regions and main transport routes through Europe. The project's web site is www.supergreenproject.eu.

This report is an update of Task 4.2, "Define application areas for smart ICTs," the second task of Work Package 4 (WP 4), namely to define application areas for smart ICT. As stated in the work plan, based on the results of Task 4.1, this task identify application areas that are promising for using ICT and information flows towards the goal of optimizing environmental attributes of a supply chain, both context-wise and geography-wise. These application areas include specific modal links, nodes such as ports or freight yards, cargo corridors, multi-modal chains, and alternative routes between specific points. The approach is holistic in the sense of encompassing also non-environmental attributes such as profitability, competitiveness, intermodal efficiency, cost-effectiveness and throughput-related parameters. A number of such application areas are defined and for each of them a list of performance attributes (both environment-wise and otherwise) is made, with specific functional linkages among them is compiled. It is linked with other Tasks of WP2 and other WPs of the project. Task 4.2 is related to 4.1 but focuses on 'application areas', and depends on Task 4.1, on WP2, benchmarking of green corridors (on the corridors selected in Task 2.1 and –to some extent- on the KPIs developed in Task 2.2). This deliverable is version 2 of D4.2, corresponding to work performed from M19 to M36 (end of the project). Version 1 was issued in M18 and led to the approach followed by Tasks 4.3 and 4.4 of WP4.

A specific methodology is used in order to come up with a set of possible ICT application areas capable of greening the transportation chain. The transport industry in EU and world scale has been progressing and has successfully adapted to changing requirements and circumstances. The ICT had play a critical role towards this transformation combined with innovative technology in intermodal chains, new types of services or business models and successful entry into new markets.

We seek for environmentally-friendly and resource-efficient solutions for the sustainable development of transportation business. This is attempted for all 9 corridors identified in Task 2.1.The freight traffic is highly concentrated on these 9 corridors and hubs, which produces transport volumes sufficient for operating viable frequent intermodal transport services. This is obvious a pull factor for the transport system. On the other hand the push factor is that hubs and on the same routes, the use of road transport is being discouraged for its heavy consumption of infrastructure capacity and its environmental impact.

The task describes possible motivations and obstacles for greener transportation and proposes solutions linked with ICT systems. Each solution is analysed presenting the rationale, the motivation and the expected improvement in financial, environmental and quality based attributes (only in a qualitative sense at this phase). ICT technologies are classified into "ICT clusters", according to the preliminary findings of the analysis.

The following clusters were decided:

- Expert charging systems
- Centralised transportation management systems
- Decentralised transportation management systems
- Broadcasting, monitoring & communication systems
- Safety systems
- E-Administrative Systems
- Emissions footprint calculator systems

Why these clusters and not a different scheme? Because we felt that this classification captures the basic functional distinctions among major categories of ICTs. In a sense it is based on the functional and attributes analysis performed Task 4.1, where all major functions of each ICT were identified along with their main attributes. The clusters aim to describe the core functionality of each ICT. In cases of multi-function ICTs we decided to which cluster to assign an ICT by focusing on its dominant feature and by using expert judgement. Thus, and even though certainly this clustering scheme is not unique, we feel that it proved useful in our analysis.

All the proposed ICTs would directly or indirectly promote fuel economy and hence fewer emissions and environmental friendliness. They would also hopefully promote ICT inter-operability especially at cross-border settings, which is very important from an EU policy perspective.

Last but not least, a list of the most vital ICTs per corridor was the subject of research in subsequent WP4 tasks (tasks 4.3 and 4.4). The updated list of innovative ICT solutions produced in Task 4.1 can provide a wider portfolio of possible solutions with similar or improved results.
The D4.2 analysis towards revealing application areas had two discrete approaches:

- Define obstacles and seek for solutions. Define all problematic areas in the corridors under examination and propose appropriate ICTs to provide vital solutions.
- Define innovations and best practices and seek for possible implementation. Define a set of best practices from other transportation areas to be transferred as innovative ICT solutions on corridors under consideration.

The selection of the application areas followed a holistic approach rather than selecting the local optimal ICT per corridor. The selected list of application areas fulfil the following terms:

- Wide selection of ICT systems from the 4.1 portfolio.
- Promising ICTs for improving societal criteria.
- Promising ICTs for improving private criteria.
- Avoid major overlaps of systems to be implemented and problematic areas to be improved.

The analysis produced the following suggestions for possible ICTs application areas per mode and per corridor:

Table 1 Selected ICTs per mode and per corridor

	Corridor	Transportation Modes	ICT Cluster (Application)	Candidate ICT	ICT Cluster (ICT Updated)
1	Mare Nostrum	SCM	Broadcasting, monitoring & communication systems	SMARTBOX or similar	CHINOS RFID, VERIWISE AGHEERA,
2	Brenner	Road Rail	Expert charging systems Centralised transportation management systems	Congestion charging ERTMS	Skymeter EREX
3	Two Seas	Maritime	Broadcasting, monitoring & Communication systems	Broadband communication: WiFi/WiMAX, digital VHF, GNSS: GPS, Glonass, Galileo	
4	Silk Way	Maritime Rail	Emissions footprint calculator systems Centralised transportation management systems	Emissions footprint calculator systems ERTMS	Sea-Trim System EREX
5	Edelweiss	Road	Emissions footprint calculator systems	Speed limits on the highway depending on CO2 emission values	Skymeter
6	Finis Terrae	Maritime Rail	E-Administrative Systems Centralised transportation management systems,(ERTMS)	JUP	5Logit SEA Logit 4SEE/ Logit D2D Navis Cosmos CATOS CITOS Mainsail /Genoa Breakbulk CITIS System MACH Infolink System DAKOSY Emodal - Valenciaportpcs.net Seagha/ APCS U-Port Port-MIS System Fretis EREX
7	Strauss	Inland waterways	Centralised transportation management systems Expert charging systems	RIS river tolls	

	Corridor	Transportation Modes	ICT Cluster (Application)	Candidate ICT	ICT Cluster (ICT Updated)
8	Nureyev	Maritime	E-Administrative Systems Centralised transportation management systems	FRETIS IBNET	5Logit SEA Logit 4SEE/ Logit D2D Navis Cosmos CATOS CITOS Mainsail /Genoa Breakbulk CITIS System MACH Infolink System DAKOSY Emodal - Valenciaportpcs.net Seagha/ APCS U-Port Port-MIS System JUP
9	Cloverleaf	Road	Decentralised transportation management systems Safety systems	platooning adaptive speed control	 Skymeter

1. Introduction- Purpose of this document

The purpose of "SuperGreen" is to promote the development of European freight transport logistics in an environmentally friendly manner. Among other work, SuperGreen will evaluate a series of corridors covering some representative regions and main transport routes through Europe. The objective of WP4 is to define and exploit the role of Information and Communications Technology (ICT) flows towards the goal of greener transport. This deliverable is version 2 of D4.2, corresponding to work performed from M18 to M36 (end) of the project. It is practically an update containing all possible ICT application areas that could lead to green transportation practices.

There have been six partners to this task: NTUA (task leader), Marintek, the University of Dortmund, D'Appolonia, DB Schenker and PSA Sines.

According to the DoW, and based on the results of Task 4.1, Task 4.2 aims to identify application areas that are promising for using ICT and information flows towards the goal of optimizing environmental attributes of a supply chain, both context-wise and geography-wise. Application areas would include specific modal links, nodes such as ports or freight yards, cargo corridors, multi-modal chains, and alternative routes between specific points. The approach will be holistic in the sense of encompassing also non-environmental attributes such as profitability, competitiveness, intermodal efficiency, cost-effectiveness and throughput-related parameters. A number of such application areas will be defined and for each of them a list of performance attributes (both environment-wise and otherwise) will be made, with specific functional linkages among them will be compiled.

It is reminded that deliverable D4.1v2 developed a classification of information flows in road, rail, maritime and, inland waterway transport, rail and road transport applications. Their mode of usage, their integration among various systems and related problems was also analysed. Main results, tools and methods of EU projects such as Freightwise, E-freight, and other related projects are presented. In that report we described how data from all these systems, tools and info flows can map onto environmental and non-environmental attributes of the supply chain that one would like to improve and establish the baseline/state-of-the-art (EU and national projects). A brief presentation of the technologies, the information transactions, and the use of data was made. We also looked on bottlenecks or other deficiencies that prevent – make difficult- the use of information, while a distinction between static vs. dynamic information flows was made. Last but not least, the task investigated how the systems outside Europe and in air transport are better than current practices in Europe, and best practices of operations from various logistics providers are studied.

D4.2v2 is an update of D4.2v1 towards two directions:

- ICT-wise. This update contains all crucial updates in ICT portfolio as derived from work carried out in Task 4.1 after the 18th month of the SuperGreen project. This updated portfolio of ICT systems can provide similar or improved solutions towards a greener and more efficient transportation chain. ICT evolution never ends; hence new innovative solutions are coming to face today and tomorrow problems in transportation industry.

- Corridor-wise. The work carried out in Task 4.3 and 4.4 after the 18th month of the project revealed some crucial attributes of the selected application areas regarding, ICT existence, obstacles, candidate problematic areas and implementation issues. This analysis in now reverting into the Task 4.2 in order to have a more concrete definition of the selected application areas.

Per project's DoW, D4.2v2 is an updated version of D4.2v1. In it one can find:

- (Breadth) Additional ICT solutions over those identified in deliverable D4.2v1 issued in M18.
  (Depth) A deeper analysis of those ICTs identified in deliverable D4.2v1.

In that sense, an important clarification is in order: even though this document provides some additional application areas for smart ICTs, as those were identified between M19 and M36, it was only possible to take on board in Task 4.4 the 'depth' dimension of the present document but not its 'breadth' dimension. The concurrent execution of Tasks 4.2 and 4.4 rendered impossible to take on board additional application areas identified in Task 4.2 within the analysis of Task 4.4, since the set of the application areas for Task 4.4 had been fixed as per deliverable D4.4v1 and the first steps of the related analysis had been completed in that deliverable. It is reminded that these application areas were drawn from the 15 'corridor/mode/ICT' scenarios chosen for the analysis of Task 4.4, analysis whose first steps were in deliverable D4.4v1 and which was subsequently completed in deliverable D4.4v2. Work in the latter deliverable was conducted in parallel with the remainder of Task 4.2 (and in fact of Task 4.1) and is being submitted separately and concurrently with deliverables D4.1v3 and D4.2v2.

In that sense, because of this concurrent execution of these tasks, the value of the additional information included in the present document (and that of D4.1v3 for that matter) is limited in the sense that it was not possible to use all of it for the remainder of the analysis of Task 4.4 in Year 3. Even so, we think that for the sake of completeness such information is worthy of note.

It is finally reminded that, after some discussion among WP4 partners, it was agreed that all 9 corridors of Task 2.1 should be looked upon in Tasks 4.2, 4.3 and 4.4, including the 3 corridors dropped in Task 2.4 (Finis Terrae, Edelweiss and Two Seas). It was realized that this would create some difficulties due to lack of data and lack of appropriate KPI baselines but it was argued that some data was available and one should give it a try.

The rest of this report is organised as follows: Section 2 describes the methodology used. Sections 3 to 11 list potential ICTs per corridor. Section 12 makes the selection of application areas and section 13 presents the conclusions of this report.

2. Methodology

After the submission of the first version of D4.2 the work further carried out in Tasks 4.1 and 4.4 is included in Deliverables D4.1 and v2 & v3 and in D4.4v2.

D4.1v2 (issued in M24) had provided the following update in the list of the available ICTs:

Update on Road ICT and information flows:

- Speed limits on the highway depending on CO2 emission values ICT (VBA Umwelt Tirol)
- (Dynamic) Traffic signalling optimization
- Platooning
- Congestion Charging
- Toll amount depending on pollutant category
- International networking of national traffic control centres
- Braking Assistant Systems (BAS)
- Intelligent Speed Adaption (ISA)
- Fleet management Software
- Telogis Route ICT
- GPS Insight ICT
- VeriWise Dry Van ICT
- IDSC LoadBuilder ICT
- RescueNet Road Safety ICT
- TRUCKSmart ICT

Update on Rail ICT and information flows :

- TAF TSI ICT
- Navis TRACS
- VeriWise for Rail ICT
- RAILTrack ICT

Update on Maritime ICT and information flows:

- AIS ICT
- Satellite AIS ICT
- ExactAIS Viewer/ marine traffic ICT
- LRIT ICT
- Port vision / port vision advantage/ PV onboard Global ICT
- TerminalSmart
- OPTIMAR
- IBNet ICT
- The Portnet2 ICT
- Logit SEA
- Logit 4SEE/ Logit D2D
- Navis
- Cosmos
- CATOS
- CITOS
- Mainsail /Genoa Breakbulk / terminal Management System

- CITIS System
- MACH System
- Port Infolink System
- GNSS, GPS, Glonass, Galileo ICTs
- VSAT, WiFi VHF ICTs

Update on Inland waterway transport
- Waterway charges and harbour dues (CHD)

D4.1v3 (issued concurrently with the present document) provides the following update in the list of the available ICTs:

Update on Road ICT and information flows:
- Freeway Traffic Management System: The COMPASS ICT
- Road Pricing, congestion charging and tolling: The Skymeter ICT

Update on Rail ICT and information flows:
- EREX Metering and saving energy ICT
- TIS Train information System ICT

Update on Maritime ICT and information flows:
- DAKOSY - the Port Community System
- Emodal - Port Community System
- Valenciaportpcsnet - Port Community System
- Seagha/ APCS - Port Community System
- U-Port / Port-MIS System
- Sea-trim system

The above-mentioned ICTs will be considered as:

- ICTs providing supplementary solutions to previous bottlenecks or
- ICTs providing adequate motivation for implementation

D4.4v2 (also issued concurrently with the present document) provides a more comprehensive description (attributes, benchmarking, status in the corridors etc) of the available ICT solutions in the selected corridors and scenarios of D4.2v1. Due to the parallel execution of D4.1v3, D4.2v2 and D4.4v3, these additional technologies could not be fully assessed through the entire D4.4 benchmarking process. However, an attempt was made to incorporate those that could provide some different solutions in terms of functionality and performance.

From the above D4.1v3 updated ICT list, we found that the Skymeter ICT and the TIS train Information ICT could have a potential implementation on the selected scenarios. More specifically:
- Skymeter could act either as an expert charging system on Road transportation in scenario 2 in the Brenner Corridor and
- As an emissions calculator on road transport in scenario 7 in Edelweiss Corridor.
- TIS could be an alternative train Information ICT system in scenarios 3, 6 and 9 in Brenner, Silk Way and Finis Terrae corridors respectively.

Details on the rationale for choosing these ICTs are provided in D4.4v3 (see section 1.3).

The figure below shows the interconnections between Task 4.2 and Tasks 4.1 & 4.4.

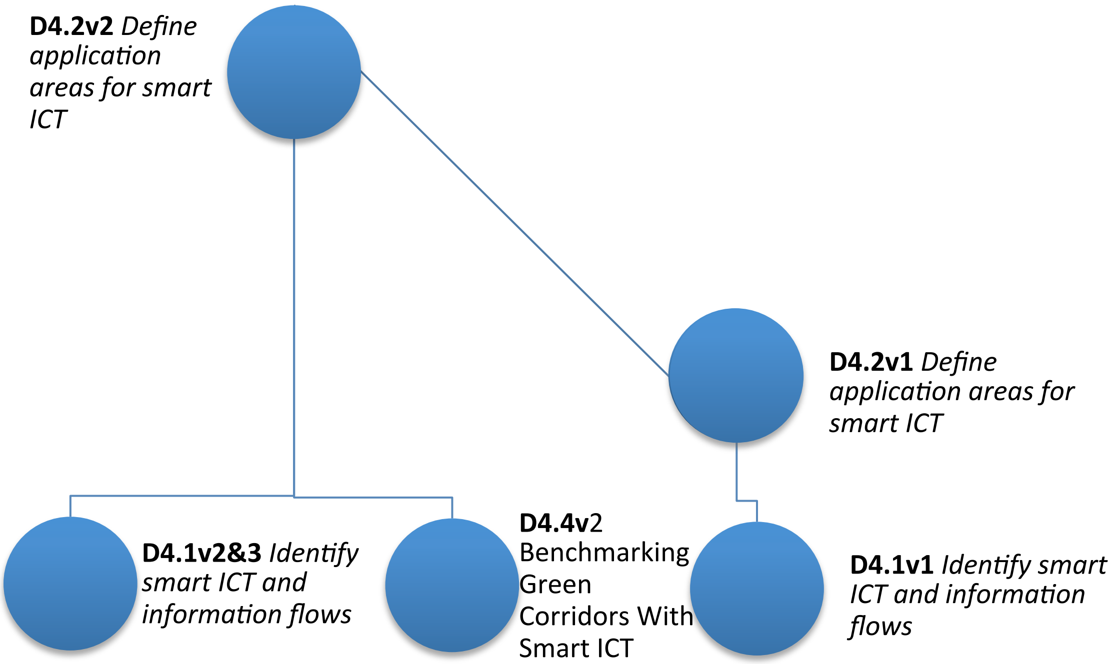

Figure 1 The Task 4.2 and Tasks 4.1&4.4 interconnections

The general methodology followed also in the previous version of D4.2 in order to define application areas for smart ICT and to come up with a final selection of ICTs for further analysis and assessment involves the following steps:

Step 1: For each of the 9 corridors selected in Task 2.1 (deliverable D2.1), identify a set of specific ICT contexts suitable for greening. In addition to D2.1 and D4.1v3, input was foreseen and has been received from the following deliverables: D2.4v2 (benchmarking of green corridors) and D2.5 (definition of areas for improvement).

In order to collect the relevant information, a dedicated questionnaire was constructed, soliciting the following:

- Application no.
- Partner responsible
- Corridor name
- Segment or transport chain
- Transport Modes
- Major Mode involved
- Other Direct Beneficiary Users

- Specific ICT technology
- Data / Information
- Installation Requirements (technology, software, data)
- Bottleneck / Motivation
- Related KPIs or Attributes

The results of this exercise are reported in detail in sections 3 to 11 of this report.

Step 2: Based on the results of Step 1, define appropriate "ICT clusters" for the proposed ICT applications. These clusters are broad ICT categories that have some common characteristics or functionalities with one another. The ICT clusters that were identified are the following:

(A) Expert charging systems: these are ICT systems whose main function is to apply charges to traffic. These can range from simple toll collection systems to more elaborate charging systems for congestion avoidance or even emissions reduction.

(B) Centralised transportation management systems: These are ICT systems devoted to managing traffic and whose decision-making scheme is centralised, such as for instance, a VTMIS or a railway traffic control system.

(C) Decentralised transportation management systems: Same as (B) but in which the decision-making scheme is decentralized. This can be for instance an intelligent highway system (IHS) in which each car has its own ICT which is interconnected with the ICT systems of other cars, but no central control exists.

(D) Broadcasting, monitoring & communication systems: These are ICTs whose main functions is provision of information to transport operators but no major decision-making is involved.

(E) Safety systems: These are ICT systems whose main function is safety.

(F) E-Administrative Systems: These are ICTs that have a major commercial functionality, such as cargo booking, ticketing, billing and other transactions.

(G) Emissions footprint calculator systems: These are ICT systems whose main function is to calculate emissions.

Of course it should be realized that systems may belong to more than one cluster. However, in this document it is attempted to classify them in what was considered to be the most prevalent cluster.

To that effect, each of the ICT applications identified in Step 1 has been classified into one of the above ICT clusters. The following table presents the ensuing taxonomy. The first column of the table shows the 'raw material' collected, the various ICT systems identified in Step 1, and the second column shows the allocated ICT cluster.

Table 2 Main clusters for smart ICT systems

ICTs	ICT cluster
Unified Electronic toll system (CHD) Congestion Charging Toll amount depending on the pollutant category of the truck (German highway truck toll system) Skymeter EREX Waterway charges and harbour dues (CHD)	Expert charging systems
ERTMS TIS Train information System ICT Freeway Traffic Management System: The COMPASS ICT RAILTrack ICT Traffic flow optimization, Caesar (or systems of individual operators like kombiverkehr, ökombi, etc) VTS/VTMIS Electronic Traffic Management, River Information Service (RIS) Fairway Information Service (FIS) Information for Law- enforcement (ILE) Traffic control systems (TMC pro/TMC Plus, GPS/GSM) OPTIMAR International networking of national traffic control centres ICT: How to assign icebreakers to other vessels Traffic signaling optimization RAILTrack ICT IBNet ICT	Centralised transportation management systems
Platooning Intelligent Speed Adaption (ISA) Speed limits on the highway depending on CO2 emission values (VBA Umwelt Tirol) RAILTrack ICT	Decentralised transportation management systems
Conducted communication systems Broadcasting systems (TMC, TMCpro, TPEG, DVB, DAB) Mobile radio systems (GSM,SMS,GPRS,UMTS) Car-to-X-Communication ENC/ECDIS Broadband communication (WiFi/WiMAX, digital VHF, etc), GNSS (GPS, Glonass, Galileo) Automatic Identification System (AIS) LRIT – Long Range Identification and Tracking, radar SafeSeaNet AGHEERA RFID SCHENKER SMARTBOX Route Guidance systems Personal navigation assistant (Navigationssysteme) Head-up display (HUD) Navigation system for trucks: Map & guide professional GPS Insight ICT VeriWise Dry Van ICT	Broadcasting, monitoring & communication systems

VeriWise for Rail ICT ExactAIS Viewer/ marine traffic ICT Port vision / port vision advantage/ PV onboard Global ICT The Portnet2 ICT	
Road-weather-information systems (SWIS, AWEKAS, GFS Europa, Coupled general Circulation Models Eumesat Polar Systems (EPS)) Speed limiter Night Vision System Distance control systems Collision warning systems Braking assistant systems Lane Departure Warning (LDW) Lane keeping assistant Adaptive speed limit RescueNet Road Safety ICT Port vision / port vision advantage/ PV on-board Global ICT	Safety systems
Single Window solutions JUP Fretis ShortSeaXML DAKOSY - the Port Community System Emodal - Port Community System Valenciaportpcsnet - Port Community System Seagha/ APCS - Port Community System U-Port / Port-MIS System TAF TSI ICT Navis TRACS Terminal Smart Logit SEA Logit 4SEE/ Logit D2D Navis Cosmos CATOS CITOS Mainsail /Genoa Breakbulk / terminal Management System CITIS System MACH System Port Infolink System	E-Administrative Systems
Anonymised sensor data gateway etc Sea-trim system	Emissions footprint calculator systems

Step 3: Based on the results of steps 1 and 2, select a set of application areas as candidates for greener transportation. The aim here is to cover all 9 corridors and all 7 ICT clusters. The results of step 3 will be reported in section 12 of this document. In this current version of D4.2 (version 2) the results will not be used for further analysis. The produced outcome is an update containing more information regarding the available ICT solutions and a more concrete description of the corridor status.

The results of this exercise are reported in the following sections of this document. The main difficulty associated with this effort has been the lack of complete information on what ICT systems exist or do not exist in each of the 9 corridors, and the general non-homogeneity of such information. The analysis that carried out in Task 4.4v2 provided crucial information on ICT implementation on the 9 corridors. The nature of the benchmarking exercise in D2.4v2 (which actually was implemented on 6 of the 9 corridors of D2.1) involved collection of information on KPIs at an aggregate level, and did not go into much detail on the technologies deployed in each corridor. The same is true as regards D2.5, which involved all 9 corridors. The main implication of this has been that the quantity and quality of collected information per each of the 9 corridors has been diverse, ranging from very good in the best cases (e.g., Brenner, Nureyev), to average in some others (e.g., Finis Terrae). However, it was decided to move on and make as best use of this information as possible.

The next 9 sections (3 to 11) report on each of the 9 corridors selected in Task 2.1.

3. Mare Nostrum corridor

The Mare Nostrum corridor includes Mediterranean and Black sea trade routes. There are nine countries involved in this approximately 6.000 kilometre purely short sea shipping corridor: Ukraine, Romania, Bulgaria, Turkey, Greece, Italy, France, Spain and Portugal.
The routes are:

Main: Odessa-Constanta-Bourgas-Istanbul-Piraeus-Gioia Tauro-Cagliari-La Spezia-Marseille-Barcelona-Valencia-Sines
Branch A: Algeciras-Valencia-Barcelona-Marseille-Lyon
Branch B: Piraeus-Trieste

The corridor serves a vast area, taking in a large part of the European Union's Eastern flank and its entire Southern part. Most ports along the corridor have good connections with all modes of transport. In addition, Odessa and Constanza have excellent connections to the inland areas via navigable rivers (Dnieper and Danube respectively).

Although the current infrastructure and connections are rather good (Odessa and Constanta have excellent connections to the inland areas via navigable rivers Dnieper and Danube respectively), there are currently several projects in progress that will provide new facilities for cargo handling and improve transport connections. A description of the bottlenecks of this corridor can be found in deliverable D2.5.

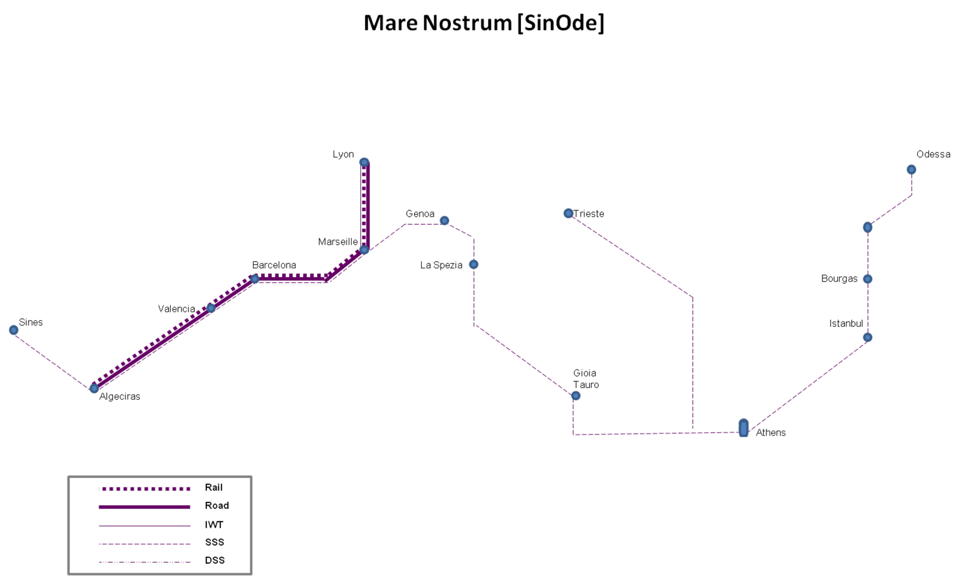

Figure 2 The Mare Nostrum Corridor

3.1 Application Areas for smart ICT

There are many obstacles, problems and motivations for improvement along the Mare Nostrum corridor. Mare Nostrum generally suffers from the problems that typically characterise waterborne transportation.

A main obstacle is that the administrative procedures are too often unnecessarily complex, redundant and not harmonised between countries or ports hence a single window application would be essential in increasing efficiency.

Other obstacles are:

- Congestion and various delays in loading unloading of cargos,
- restrained environmental system,
- increased risk of collision,
- low service quality, lack of reliability,
- aged technological systems,
- lack of monitoring and integration,
- Lack of emission footprint data etc.
- Difficulty in Pilotage services
- capacity problems of existing port facilities (Insufficient cargo loading/unloading and handling capacities)
- problematic road and rail hinterland connections (Insufficient capacity of road and rail connections causes serious congestion problems)

All the proposed ICT solutions try to face the needs for improved attributes of transportation service, in terms of quality, cost minimisation, fleet utilization and of course environmental friendliness. For example we found (see also D2.5) that there is need for satellite-based ICT applications (e.g. cargo tracking and tracing, e-maritime/e-freight/e-customs). The solutions cover all geographical area of the corridor and all the transportation chain parties (mainly vessels and ports). ICT applications can in general increase efficiency and may show a measurable improvement in all related KPIs.

The tracking platforms (e.g smartbox, VeriWise) platform generate virtually real-time information on the condition of the asset and commodity – resulting in greater visibility, enhanced shipment monitoring, customer preparedness and increased safety. According to Task 4.4 the presence of Tracking units (eg. smartbox) or similar technologies (very-wise) in this corridor is very limited. This situation is expected to change in the future, as the stakeholders will identify the positive effects of such systems. According to shipping companies regarding the presence of similar system in the Mare Nostrum corridor these systems have a presence limited to 3-5% of the transported TEUs. According to market experts, customers that use tracking units are those whose goods are very valuable or subject to deterioration due to environmental or handling activities. These clients are a small percentage of the total client base so the number of containers that are instrumented and actively tracked through instrumentation is very small. Estimates are less than 5% of containers and most likely less than 1%.

The Mare Nostrum Corridor has segments involving short sea and deep sea shipping, rail and road transportation. All modes of transport can benefit from the implementation of the tracking units. Shippers, logistics services providers, transportation services companies and practically any other industry that owns mobile assets can utilize tracking units to achieve continuous tracking of shipping containers, rail cars, truck trailers, and barges while in transit - anywhere in the Mare Nostrum Corridor. It is clear that the Mare Nostrum corridor is a niche market for tracking units and has a vast potential for implementation of Tracking units ICT.

The following tables depict the summary of the proposed ICT application areas promising for greening in the Mare Nostrum corridor. Links to related attributes are also shown.

Table 3 Main application areas for smart ICT systems at Mare Nostrum corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	NTUA	Mare Nostrum	Ports in general in the Mediterranean Sea	sea		Centralised Vessel Traffic Service (VTS)	standardized electronic charts and standardized notices to Skippers	Vessel Traffic Service (VTS)	Current port operating systems are semi automated Due to the weather conditions of the Aegean Sea (strong winds) and the existence of islets, rocks, reefs, etc. the navigability is dangerous, when visibility is low, or the ship crew is not familiar with the waters.	Minimization of waiting times / congestion through optimized scheduling of vessels. The Aegean Sea is very sensitive vis a vis environmental catastrophes from ship accidents. Due to the transport of hazardous goods (especially oil and liquefied gas) accidents and their resulting pollution can be severe. Fewer emissions.

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
2	NTUA	Mare Nostrum	Ports in general in the Mediterranean Sea (Piraeus)	sea		Electronic Traffic Management	Electronic Traffic Management	Electronic Traffic Management	Necessity to regulate speed and economize fuel. Waiting times are frequently totally unacceptable.	Reduction of waiting times, lock operators can inform the captain of his RTA [Requested Time of Arrival], informing him of the necessity to regulate speed and economize fuel - fewer emissions..
3	NTUA DUT	Mare Nostrum	Aegean Sea shipping routes, mainly narrow, shallow or busy straits. Piraeus Port and other ports	sea		Automatic Identification System (AIS) Satellite AIS GPS Insight ICT ExactAIS Viewer/ marine traffic ICT Port vision / port vision advantage/ PV onboard Global ICT The Portnet2 ICT	identifying and locating vessels (position, course, speed)	standardized VHF transceiver, positioning system such as a LORAN-C or GPS receiver, ship's navigational sensors (typically its global navigation satellite system (GNSS) receiver and gyrocompass)	High utilization, difficult navigability	Collision avoidance, managing ship traffic, aids to navigation, Accident Investigation. The improved AIS results in a prevention of accidents and accordingly in less harms to humans, nature and equipment.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
4	NTUA	Mare Nostrum	Aegean Sea shipping routes, narrow, shallow or busy straits. Piraeus Port and other ports	Sea		Port Community Systems / Single Window solutions	Time schedules, port resource management, electronic information exchange (EDI), traffic statistics	IT systems, sensors, web cameras	Port logistics, traffic monitoring, cargo tracking	Congestion, fewer emissions.
5	NTUA	Mare Nostrum	Ports in general in the Mediterranean Sea	SSS		ShortSeaXML	Schedule, Booking, Manifest, Status	ICT systems and applications which incorporates the ShortSeaXML standard	Increase efficiency in transport related operations	Service quality Transport time Reliability Congestion
6	NTUA	Mare Nostrum	entire corridor			remote monitoring of shipments and assets via GPRS technology / electronic tracking technology	arrival times, continuous inventory report	AGHEERA hardware and software components	Better scheduling and optimization of fleet, as arrival times, and traceability improve. Better information to re-optimize production / supply plans in real time. Better order fulfillment rate to end customers Better information to re-optimize production/ supply plans in real time	fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
									Decreased stock-in-transit for customer goods Better time-to-market for critical products Better information to re-optimize production/ supply plans in real time based on events in the supply chain Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	
7	NTUA	Mare Nostrum	entire corridor	intermod al		real time tracking of containers with valuable loads / Sensor technologies / position data provided by GPS/ data transmission via GPRS network	arrival times, continuous inventory report	SCHENKER SMARTBOX hardware and software components,Veri Wise	better scheduling and optimization of fleet, as arrival times, and traceability improve. Better information to re-optimize production/ supply plans in real time. Better order fulfillment rate to end customers	fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									Better information to re-optimize production/ supply plans in real time Decreased stock-in-transit for customer goods Better time-to-market for critical products Better information to re-optimize production/ supply plans in real time based on events in the supply chain. Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	
8	NTUA	Mare Nostrum	Entire corridor			anonymised sensor data gateway sea-trim system	Collect consumption emissions data	Relative sensors	Obtain information about emissions per individual vehicles	Environmental and economic attributes

Table 4 Main application areas for smart ICT systems at Mare Nostrum corridor (2/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	PSAS	Mare Nostrum	All	SSS	Rail, Road	VTMIS/VTS	Vessel tracking information, vessel identity	VTMIS/VTS system components	Decrease Congestion, improve safety & security	Transit time, reliability, congestion, admin bottlenecks, safety & security, fewer emissions.
2	PSAS	Mare Nostrum	All	SSS	Rail, Road	RFID, veriwise	RFID	RFID sensors, electronic tags, receivers	Enhance Reliability, solve admin bottlenecks	Cost, transit time, reliability, admin bottlenecks
3	PSAS	Mare Nostrum	All	SSS		TOS	Vessel routeing information	TOS system components and compatible ICTs	Decrease Cost, overcome physical bottlenecks and solve admin bottlenecks	Cost, transit time, congestion
4	PSAS	Mare Nostrum	All	SSS	Rail	JUP single window application	Vessel, cargo, route information	JUP system components and compatible ICTs	Improve Reliability, solve admin bottlenecks, improve safety & security	Cost, transit time, reliability, congestion, admin bottlenecks, safety & security, fewer emissions.
5	PSAS	Mare Nostrum	All	SSS	Road	SSD	Vessel routeing information	SSD system components and compatible ICTs	Decrease Cost, improve reliability, eliminate congestion and physical bottlenecks and solve admin bottlenecks	Cost, transit time, reliability, admin bottlenecks
6	PSAS	Mare Nostrum	All	All		AGHEERA, Veriwise	Tracking data, cargo identity, incident	Light, movement, temperature Sensors, gps	Enhance Reliability overcome physical bottlenecks and admin bottlenecks,	Cost, reliability, physical bottlenecks, admin bottlenecks, safety & security,

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							record various attributes	receiver, gsm antennas	increase safety & security	fewer emissions.
7	PSAS	Mare Nostrum	All	All		OPTIMAR	Vehicle identity, tracking info	OPTIMAR system components and compatible ICTs	Decrease Cost, transit time and congestion	Cost, transit time, congestion, fewer emissions.
8	PSAS	Mare Nostrum	All	SSS	Rail, Road	SHORTSEA XLM	Schedule, Booking, Manifest, Status	ICT systems and applications which incorporates the ShortSeaXML standard	Improve Reliability, solve admin bottlenecks and increase safety & security	Cost, transit time, reliability, Admin bottlenecks, safety & security

4. Brenner corridor

This corridor concerns freight transport from Berlin, Germany to Palermo, Italy and Athens, Greece through the Italian peninsula. It involves crossing of the Alps through the Brenner pass, as well as crossing of the Ionian and Adriatic seas (Brenner Pass is the most important route for road freight transport crossing the Alps). It also includes the Tauern axis (Salzburg-Trieste).

The corridor is mainly rail- and road-based. There are parts that are handled by short sea shipping, such as Naples-Palermo and Patras/Igoumenitsa to Brindisi/Bari/Ancona.

There are several projects ongoing along the corridor to upgrade and modernize the current network. Tunnels (Brenner) and bridges (Ebensfeld-Erfurt, Messina) are being built.

Double track, high–speed railway lines are under construction. The port of Patras will be relocated in order to ensure sufficient in-land space and good connection to the intercity network. ERTMS (The European Railway Traffic Management System) will be introduced on the Munich –Verona rail line until 2015.

The railway axis Berlin-Verona/Milan-Bologna-Naples- Messina-Palermo is an important high capacity north-south rail axis crossing the Alps along the Brenner Corridor.
Traversing Germany, Austria and Italy, the axis will link up their important urban areas and deliver an important increase in transport capacity. This will allow a modal shift from road to rail in the sensitive mountainous regions it crosses.

The main part of corridor is composed by the following segments:
Malmö – Trelleborg - Rostock/Sassnitz – Berlin – Munich – Salzburg – Verona – Bologna – Naples – Messina – Palermo

The corridor has also the following two branches:
Branch A: Salzburg-Villach-Trieste (Tauern axis)
Branch B: Bologna-Ancona/Bari/Brindisi-Igoumenitsa/Patras-Athens

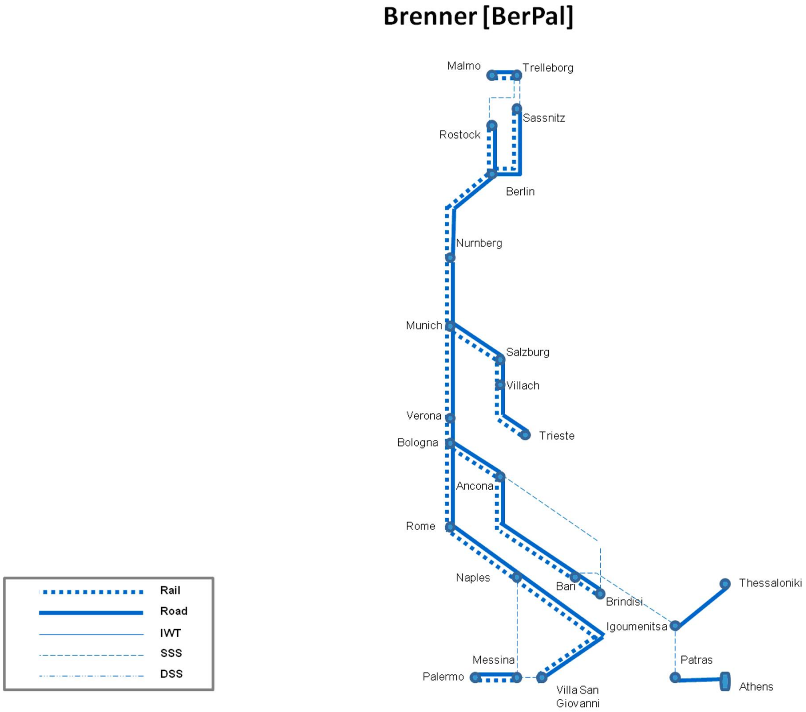

Figure 3 The Brenner Corridor

4.1 Application Areas for smart ICT

Along the Brenner Corridor, ICT technologies could help in solving specific bottlenecks more on the road transport network than on the railway one. The region of the Brenner has already been recognized as a particularly environmentally sensitive area. The bottlenecks present along the Brenner Corridor that can be solved using ICT technologies are relevant to road transport and railways.

ICT technologies applied on the railway, like the ERTMS (European Railway Traffic Management), could in fact help in creating a single Europe-wide standard for the train control and command systems and could bring improvement to traffic supporting interoperability (see also D2.5). Regarding the railway network, an analysis (Petersen M.S. et. al., 2009) has shown an increase on rail freight transport of 78% with respect to the baseline scenario of year 2008.

The system, in fact, enhances the cross border interoperability and the signalling procurement. According to the website of ERTMS Users Group1 the current member states comprises Spain (Adif), Denmark (Banedanmark), Germany (DB AG), England (Network Rail), The Netherlands (Prorail), France (RFF), Italy (RFI), Switzerland (SBB) and Sweden (Trafikkverket).

The currently commercial Applications of ERTMS in Germany are

Berlin – Halle / Leipzig:

[1] http://www.ertms.be/index.php?option=com_content&task=view&id=25&Itemid=47

The line includes 3 sections:

- Jüterbog – Leipzig (south section of the pilot line), ca. 95 km
- Ludwigsfelde – Jüterbog (north section of the pilot line), ca. 40 km
- Teltow-Ludwigsfelde (additional section for commercial service), ca. 13 km

In general the ERTMS (The European Railway Traffic Management System) will be introduced on the Munich –Verona rail line until 2015.

The section A started commercial operation with ERTMS level 2 since December 2005, the Section B started commercial operation in July 2006 and the Section C will start commercial operation in 2008. All sections have ETCS L2 equipment in parallel to LZB/PZB. High speed trains equipped with ETCS run the operational passenger service in parallel with high speed trains equipped with LZB/PZB (both 200 km/h) and with regional and freight trains equipped with PZB (160 km/h) and 5 Locomotives BR 101 are equipped with ETCS LD for commercial service
ERTMS in general has the following benefits:

- Increased safety
- Increased capacity
- Decreased maintenance
- Improved interoperability & reduced cost

The ERTMS installation in the Brenner Corridor scenario has already been reflected on going or projected national and European rail projects. Brenner corridor included in the corridors identified by the EU to be ERTMS equipped by 2020. For example in Germany the segment Nürnberg – Ingolstadt – München is putting into service on 12/2013 ETCS Level 2, SRS 2.3.0d (a parallel installation of ETCS and LZB/PZB 90)

The result of the application of this technologies would bring to a better European railway interoperability that should favour the shift of transport goods from road to rail also helping in solving specific congestion bottlenecks of the road transport network.

Other systems, like for example the Caesar one, would contribute to improve the rail transport providing the time schedules from terminal to terminal for combined transport lines of the main transport companies in Europe; other tool, like the TAF TSI ICT and the RAIL Track ICT, are good supports to reduce the total cost and increasing the productivity of the rail sector by fostering the modal shift from road to rail. The TAF TSI ICT is very useful to go in the direction of a European standardisation.

Acoustic and chemical pollution is present and it is a major social problem at the European area hence the proposed ICT should help to reduce traffic on the roads and also contribute to the improvement of the quality of the life at zone of the Brenner Pass. Seasonality is present and during summer seasons there are delays in boarding trucks on ships at Port of Brindisi in Italy and Port of Patras in Greece due to the boarding priority dedicated to tourists in these months.

Along the road network of the Brenner Corridor three specific bottlenecks have been foreseen up to 2030 on the Italian segment between Bologna and Naples, close to the cities of Florence, Rome and Naples. Also in the Greek segment, between Patras and Athens, road congestion problems are present due to the close location of the Port of Patras to the urban city centre.

Several ICT technologies could be applied on these segments to solve bottlenecks like for example the ITS (Intelligent Transportation System), the Conducted Communication Systems, the Traffic Signalling Optimization and the Expert Charging Systems.

The first application adds information and communications technology to transport infrastructure and vehicles in an effort to manage factors that typically are at odds with each other, such as vehicles, loads and routes to improve safety and reduce vehicle wear, transportation times, and fuel consumption. Different intelligent transport systems with different technologies and functionalities can be considered as ITS.

Technologies as Conducted Communications Systems and Traffic Optimization would help to make the driver more informed on the traffic and weather situations on one hand and to better organize the traffic regulation on the other hand also specific equipment could be installed on the vehicles to provide information and communication to the drivers and improving the routing. These systems feature communication both broadcasting and dedicating info supply using the GSM, GPRS, UMTS networks, the wireless LAN between road vehicles or infrastructure facilities and the GPS or Galileo applications.

The expert charging Systems as the Congestion Charging are a systems of surcharging users of a transport network in periods of peak demand to reduce traffic congestion and CO2 emissions for a better quality of life of the citizens.

The lack of harmonization of ICT systems and lack of (emissions) data is also present.

Table 5 Main application areas for smart ICT systems at Brenner corridor (1/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	NTUA	Brenner	Igoumenitsa/Patras-Athens	road		Curve Speed Warning (CSW)	Curve Speed Warning (CSW)		Dangerous road conditions, old highway specifications	More traffic safety, (external) less costs. The technology has been developed to help drivers identify potentially dangerous situations if a bend in the road is taken too fast, and warn the driver in advance allowing him time to react properly, fewer emissions.
1	DUT	Brenner	Igoumenitsa/Patras-Athens	SSS		ShortSeaXML	These messages have been developed so far: Schedule, Booking, Manifest, Status. An invoice message will be available as soon as the UN Cross Industry Invoice message is ready.	ICT systems and applications which incorporates the ShortSeaXML standard	Increase efficiency in transport related operations.	Absolute and relative costs Service quality Transport time Reliability Congestion Bottlenecks ICT applications Short Sea Shipping (SSS) implements mostly the same ICT systems as for Deep Sea. ShortSeaXML is however developed specifically for SSS.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
2	NTUA	Brenner	Toll systems in Greece	road		Unified Electronic toll system (CHD)	Unified Electronic toll system (CHD)	Elecronic Traffic Management	Different toll systems throughout the country / Excessive number	Decrease local congestion around toll stations and multitude of unnecessary frequent decreases of speed, fewer emissions.
3	NTUA	Brenner	Munich – Verona rail line	rail		ERTMS (The European Railway Traffic Management System)	ERTMS (The European Railway Traffic Management System)	ERTMS (The European Railway Traffic Management System)	Interoperability problems in rail networks of different countries	Higher capacity, security, speed and interoperability of international railway transport to improve the market position of rail traffic compared to road traffic., fewer emissions.
4	NTUA	Brenner	entire corridor			remote monitoring of shipments and assets via GPRS technology / electronic tracking technology	arrival times, continuous inventory report	AGHEERA hardware and software components	Better scheduling and optimisation of fleet, as arrival times, and trackability improve. Better information to re-optimize production/ supply plans in real time. Better order fulfillment rate to end customers Better information to re-optimize production/ supply plans in real time Decreased stock-in-transit for customer goods. Better time-to-market for critical products Better information to re-optimize	Fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									production/ supply plans in real time based on events in the supply chain Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	
5	NTUA	Brenner	entire corridor	interm odal		SCHENKER SMARTBOX , Veri-wise	arrival times, continuous inventory report real time tracking of containers with valuable loads / Sensor technologies / position data provided by GPS/ data transmission via GPRS network	SCHENKER SMARTBOX / veriwise hardware and software components	Better scheduling and optimization of fleet, as arrival times, and trackability improve. Better information to re-optimize production/ supply plans in real time Better order fulfillment rate to end customers Better information to re-optimize production/ supply plans in real time Decreased stock-in-transit for customer goods Better time-to-market for critical products Better information to re-optimize production/ supply	Fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									plans in real time based on events in the supply chain Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	
6	DAP/ NTUA	Brenner	Balkan railway network	Rail		ERTMS-European Railway Traffic Management	Initiative to enhance cross-border interoperability and signaling procurement by creating a single Europe-wide standard for train control and command systems.	Balises, Interlocking, Traffic management system (ETCS Level 1 or 2)	Could bring improvement to traffic supporting interoperability	Reliability, ICT applications

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
7	DUT / NTUA	Brenner	Greek ports	sea	………	FRETIS/ single window application system	Cargo documents, tracking and tracing, landside container movements, information regarding the loading and unloading of vessels or trains, invoicing, etc.	XML, web-clients, Optical Character Recognition, client-server applications, WLAN	Extension of capacity	Increase of throughput, decrease in waiting times and enhancing competitiveness
8	DUT / NTUA	Brenner	Central European railway network	rail		Traffic flow optimization by emkamatik	Railway schedule	Optimization packages	Coasting; reducing maximum speed; and lower grades of acceleration and deceleration (earlier braking and use of electric, regenerative brakes).	Energy economization, fewer emissions.
9	NTUA	Brenner	Entire Corridor			Anonymised sensor data gateway skymeter	Collect consumption emissions data	Relative sensors	Obtain information about emissions per individual vehicles	Environmental and economic attributes

Table 6 Main application areas for smart ICT systems at Brenner corridor (2/2)

No.	Partner	Corridor	Segment	Transport Modes	Specific ICT	Data /	Installation	Bottleneck /	Related KPIs or

			or transport chain	Major Mode	Other Direct Beneficiary Users	technology	Information	Requirements (technology, software, data)	Motivation	Attributes
1	DAP	Brenner	Bologna-Roma	Rail		ERTMS-European Railway Traffic Management	Initiative to enhance cross-border interoperability and signaling procurement by creating a single Europe-wide standard for train control and command systems.	Balises, Interlocking, Traffic management system (ETCS Level 1 or 2)	Could bring improvement to traffic supporting interoperability. At the moment high speed Rail has a gap between Bologna and Roma Enhancement of conventional lines - financial viability to be duly verified	Reliability, ICT applications, fewer emissions.
2	DAP	Brenner	Salzburg-Munich	Rail		ERTMS-European Railway Traffic Management	Initiative to enhance cross-border interoperability and signaling procurement by creating a single Europe-wide standard for train control and command systems.	Balises, Interlocking, Traffic management system (ETCS Level 1 or 2)	Could bring improvement to traffic supporting interoperability. At the moment high speed Rail is present in Austria up to Salzburg and in Germany it passes through Munich.There is a gap between Salzburg and Munich Enhancement of conventional lines - financial viability to be duly verified	Reliability, ICT applications, fewer emissions.
3	DAP	Brenner	Bologna – Roma - Naples	Road		Intelligent Transportation System (ITS)	These systems add information and	Intelligent transport systems vary in technologies	Three bottlenecks on the segment have been foreseen up to 2030 (close to	Congestion, frequency, ICT applications, bottlenecks, fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							communications technology to transport infrastructure and vehicles in an effort to manage factors that typically are at odds with each other, such as vehicles, loads and routes to improve safety and reduce vehicle wear, transportation times, and fuel consumption.	applied.	Florence, Rome and Naples) The bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009	
4	DAP	Brenner	Bologna – Roma - Naples	Road		Conducted communication systems	Offers the driver detailed information about the traffic and weather situation as accurately, completely and rapidly as possible.	Variable traffic signs, dynamic road control systems	Three bottlenecks on the segment have been foreseen up to 2030 (close to Florence, Rome and Naples)	Congestion, frequency, ICT applications, bottlenecks The bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
5	DAP	Brenner	Bologna – Roma - Naples	Road		Traffic signalling optimization	Maintaining signalized intersections at	Management SW for traffic light		Congestion, frequency, ICT applications, bottlenecks The

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							their optimal performance for different demand conditions	synchronisation and traffic improvements		bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
6	DAP	Brenner	Bologna – Roma - Naples	Road		Broadcasting systems (TMC, TMCpro, TPEG, DVB, DAB).	These are system to broadcast and send traffic information to be integrated with NAVSAT for improved routing	Base network, on board equipment		Congestion, frequency, ICT applications, bottlenecks The bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
7	DAP	Brenner	Bologna – Roma - Naples	Road		Mobile radio systems (GSM,SMS,GPRS,UMTS)	These systems feature commuinication both broadcasting and dedicated info supply	GSM,GPRS,UMTS networks		Congestion, frequency, ICT applications, bottlenecks The bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
8	DAP	Brenner	Bologna – Roma - Naples	Road		Car-to-X-Communication.	Communication of road vehicles via wireless LAN with other road vehicles or infrastructure facilities	Short range communication devices; base netwokr		Congestion, frequency, ICT applications, bottlenecks The bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
9	DAP	Brenner	Bologna – Roma - Naples	Road		Route Guidance systems	NAVSAT for routing	GPS, GALILEO		Congestion, frequency, ICT applications, bottlenecks The

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
						Personal navigation assistant (Navigations systeme)				bottlenecks in Florence, Rome and Naples have been foreseen by Petersen M.S. in 2009, fewer emissions.
10	DAP	Brenner	Bologna – Roma - Naples	Road		Platooning	Decrease the distances between cars using electronic, and possibly mechanical, coupling. Increase of lane capacity to reduce traffic jams	Platoon capability might require buying new cars, or it may be something that can be retrofitted		
11	DAP	Brenner	Bologna – Roma - Naples	Road		Congestion Charging	System of surcharging users of a transport network in periods of peak demand to reduce traffic congestion	variable tariff system		
12	DAP	Brenner	Munchen - Nurnberg	Rail		Caesar (or systems of individual operators like kombiverkehr, ökombi,…)	Provides times schedules for combined transport lines of the main combined transport	Seamless interfacing of information between the different players	Slot restriction foreseen in the future	Frequency

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							companies in Europe from terminal-to-terminal			
13	DAP	Brenner	Patras - Athens	Road		Intelligent transportation system (ITS)	These systems add information and communications technology to transport infrastructure and vehicles in an effort to manage factors that typically are at odds with each other, such as vehicles, loads and routes to improve safety and reduce vehicle wear, transportation times, and fuel consumption.	Internet, WiFi network, On Boad Terminals and computers,	The port of Patras is located close to the urban center of the city, causing problems for increasing passenger and freight traffic while traffic related nuisance inflicts to the population living near the port.	Congestion, frequency, ICT applications, bottlenecks, fewer emissions.
14	DAP	Brenner	Patras - Athens	Road		Broadcasting systems (TMC, TMCpro, TPEG, DVB, DAB).	These are system to broadcast and send traffic information top be	Base network, on board equipment		

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							integrated with NAVSAT for improved routing			
15	DAP	Brenner	Patras - Athens	Road		Mobile radio systems (GSM,SMS,GPRS,UMTS)	These systems feature commuinication both broadcasting and dedicated info supply	GSM,GPRS,UMTS networks		
						Route Guidance systems Personal navigation assistant (Navigationssysteme)	NAVSAT for routing	GPS, GALILEO		
16	DAP	Brenner	Patras - Athens	Road		Congestion Charging	System of surcharging users of a transport network in periods of peak demand to reduce traffic congestion			
17	DAP	Brenner	Baltic Sea Area	Road		Road-weather-information systems (SWIS,	Automatic environmental data collection sensors	Sensoring, base network	During hard winters, ice in the Baltic Sea might cause delays. Weather conditions	Congestion, frequency, ICT applications, relative cost, fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
						AWEKAS, GFS Europa, Coupled general Circulation Models Eumesat Polar Systems (EPS)) are used to avoid accidents and to optimize the highway maintenance	recording lane temperature, intensity of rainfall, solar radiation, humidity and wind direction.		like black ice or limited visibility in thick fog can be detected on time. Traffic computer centres control and coordinate the traffic guidance systems on the highway. They use the weather data and forecasts to display correct messages and speed limits on the electronic traffic signs and to coordinate the road maintenance. Less external costs, e.g. optimized salt usage in winter times	
18	DAP	Brenner	Motorways	Road		Speed limits on the highway depending on CO2 emission values (VBA Umwelt Tirol)	CO2 emission sensors and dynamic electronic traffic signs are used to reduce the displayed speed limit automatically, if the CO2 boundary value	sensors recording the traffic volume and the CO2 emission	Could bring improvement to traffic supporting interoperability These technologies can be applied in each segment of the corridors involving roads transport. Their impact is more relevant in segments	Pollutant missions, congestion

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							is exceeded		characterized by highest traffics volumes	
19	DAP	Brenner	Motorways			Traffic signalling optimization		Variable traffic signs		
20	DAP	Brenner	Motorways			Intelligent Speed Adaption (ISA) Speed limiter	System that constantly monitor vehicle speed and the local speed limit on a road and implements an action when the vehicle is detected to be exceeding the speed limit.			
21	DAP	Brenner	Motorways			Toll amount depending on the pollutant category of the truck (German highway truck toll system)		pollutant sensors		
22	SCH	Brenner	Copenhagen – Hamburg - Hannover	road		AMV Verkehrsmanagement Audio Mobil			Currently the segment is dominated by traditional truck services with low use of information technologies	
						Conducted communication				

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
						systems(variable traffic signs, dynamic road control systems)				
						Broadcasting systems(TMC, TMCpro, TPEG, DVB, DAB).				
						Mobile radio systems (GSM,SMS,GPRS,UMTS)				
						Innovative applications				
						Route Guidance systems Personal navigation assistant (Navigationssysteme)				
						Fuel- efficient route choice				
						Green trucks				

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
						Anonymised sensor data gateway				
23	SCH	Brenner	Munchen - Nurnberg	Rail		Caesar (or systems of individual operators like kombiverkehr, ökombi,…)			Slot restriction foreseen in the future	
23	SCH	Brenner	Patras - Athens	road		Intelligent transportation system (ITS)			The port of Patras is located close to the urban center of the city, causing problems for increasing passenger and freight traffic, while traffic related nuisance inflicts to the population living near the port.	
						Broadcasting systems(TMC, TMCpro, TPEG, DVB, DAB).				
						Mobile radio systems (GSM,SMS,GPRS,UMTS)				
						Route Guidance systems Personal navigation assistant (Navigationssysteme)				
						Congestion Charging				

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
24	DAP	Brenner	Italian, Greek segments	Road		Expert charging ICT	Electronic toll collection system for trucks over 3.5tonnes based on: distance covered, weight and type of vehicle (as already applied in Austria and Germany)		Highways congestion (the systems could help to encourage modal shift and reduce road congestion)	Modal shift from road to rail, helps the reduction of CO2 emissions.
25	DAP	Brenner	Motorways	Road		Braking Assistant Systems (BAS)	It is a power brake unit attached in a vehicle that increases the pedal pressure up to the possible maximum of braking pressure in an emergency situation.	power brake unit attached in the vehicle	Improve the safety of vehicle and people	Quality of life
26	Dap	Brenner	Motorways	Road		Telogis Route ICT	It is a Multi-vehicle route optimization tool for both strategic and tactical	web-based Software-as-a-Service (SaaS)	Traffic congestion, improvement of efficiency, reducing of costs	Efficiency, traffic congestion, reduction of costs

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							resource planning. Telogis Route provide visibility in routing costs and an instant feedback on route plans..			
27	Dap	Brenner	Motorways	Road		GPS Insight ICT	The system provides insight via real-time maps, vehicle location lists, alerts, graphs, messages, landmark visits, schedule reports, set up alerts or administer vehicle and driver.		Reduce fuel consumption and CO2 emissions	Reduce fuel costs Improve productivity
28	Dap	Brenner	railways	rail		TAF TSI ICT	TAF-TSI is a system integration project undertaken by the European rail freight industry. The project is		Reduction of costs, improving standardisation,	cost-effective

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							based on harmonised business processes supported by standardised.			
29	Dap	Brenner	railway	rail		RAILTrack ICT	It is a solution, providing rail terminals of any size with all the required planning, operational and management tools their business requires.		Reduction of the tco (total cost of ownership); improving productivity,	Cost reduction, productivity

5. Two Seas corridor

The Two Seas Corridor links the Baltic and the Mediterranean Seas. It connects Greece and Germany through several European countries such as Bulgaria, Serbia, Hungary, Slovakia, and Czech Republic. The corridor is rail and road-based.

The Two Seas corridor route is:
Igoumenitsa/Patras-Athens-Sofia-Budapest-Vienna-Prague-Nurnberg/Dresden-Hamburg.

This is a 3500 kilometre corridor linking Greece to Germany via Bulgaria, Romania, Hungary, Austria, and the Czech Republic. The corridor includes road and rail possibilities.

This corridor is TEN-T priority project 22. There is a number of ongoing projects to improve both rail and road connections and border sections. Railway projects include modernization, reconstruction and upgrading tracks, nodes, stations, electrification of the railway line and building double railway lines along the corridor. In addition, a significant project that will help eliminate one of the current bottlenecks is the construction of a Danube bridge in Romania.

Figure 4 The Two Seas Corridor

5.1 Application Areas for smart ICT

The existing segment of Greek National Road 8A between Corinth – Patras is considered the most dangerous section of the Greek road network due to its inadequate capacity combined with dense traffic of private cars and heavy goods vehicles moving to and from the port of Patras.

High traffic volumes is a usual fact out along the border crossing between Germany and Czech Republic, Czech Republic and Slovakia, Slovakia and Hungary, Bulgaria and Greece. Obstacles due to lack of capacity and road condition problems are foreseen (Petersen M.S., et.al. 2009) in Prague and Bratislava regions

Two Seas is a transport corridor using road and rail transport. The table below identifies potential Information and Communication Technologies (ICT) which can support the identified KPI's for the corridor. The table also identifies some other technologies which can contribute with information input to the ICT systems.

For communication, information and data exchange WiMAX is a viable alternative. It is long range and has high bandwidth capacity. WiFi is an alternative where WiMAX is not deployed. However, WiFi is short range and are not meant for moveable targets. Mobile systems like 3G, Edge and future LTE are possible communication systems. The car-to-x system gives advance warnings of traffic, emergency vehicles and weather hazards by enabling one car to beam warnings directly to others.

Providing position data to planning and monitoring tools can be done by using GNSS, like GPS. Glonass is also a system that can be used, and in future the European Galileo system. Planning tools exists for parts of road and rail systems, for example Traffic flow management and TDS (Train Control System based on a new GPS application method). Input to monitoring tools can be provided by GNSS, sensors (e.g. RFID for cargo tracking and sensors for emission monitoring, motion detection sensors). Web- and video cameras are also important in monitoring applications. In general, one can say that broadcasting technologies are good for two things:

- Information can timely be broadcasted to the drivers of the vehicles. Such information is necessary in order to make "on-site" decisions for safer and more efficient transport.
- Observations and status updates can be returned back from vehicles to operations centres and decision makers, who can use the information to make decisions that have an overall positive effect on the transport corridor, or the intermodal chain.

Important principles that need to be included in order to increase efficiency are interoperability (e.g. between ICT systems), automatization of information exchange (less manual input), access to real time data/information and good presentation of information. It must be easy to put information into the system (e.g. by using portable units) and easy to get information out of it (e.g. web services, web portals etc.).

At this point the investigation on a corridor-specific basis did not succeeded in revealing to what extent and in what segments and/or transport chains of that corridor the broadcasting ICT system under consideration (a) exists, (b) does not exist but there is a plan for its application, (c) does not exist and there is no plan. The Two Seas corridor is covered half by ERTMS. From Hamburg to Budapest at variable level, thus some parts of the corridor are already established with ERTMS level 1. Some parts are planned for implementation until 2015. From Budapest to Athens, the network is part of TEN-T programme but no ERTMS plan is documented. The implementation of broadcasting technology for the corridor is therefore much more relevant to the Budapest to Athens link, while Hamburg to Budapest link would benefit from the ERTMS application more.

The next tables show the possible application of ICT with a potential for greener transportation

Table 7 Main application areas for smart ICT systems at Two Sea corridor (1/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	NTUA	Two seas	Eastern Europe (Balkan) and Greek highways	road		Intelligent Speed Adaption (ISA), Speed limiter, Night Vision System, Distance control systems, Collision warning systems, Braking assistant systems, Lane Departure Warning (LDW), Lane keeping assistant, Head-up display (HUD), Navigation system for trucks: Map & guide professional	road conditions	Intelligent Speed Adaption (ISA), Speed limiter, Night Vision System, Distance control systems, Collision warning systems, Braking assistant systems, Lane Departure Warning (LDW),Lane keeping assistant, Head-up display (HUD), Navigation system for trucks: Map & guide professional	Old road network with many risks for truck drivers	More traffic safety, (external) less costs
2	NTUA	Two seas	Eastern Europe (Balkan) and Greek highways	road		International networking of national traffic control centres (like Austrian VMIZ / Bavarian VIB)	Road conditions	International networking of national traffic control centres (like Austrian VMIZ / Bavarian VIB)	Frequent traffic jams	Fuel consumption, fewer emissions.

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
3	DUT	Two Seas	Eastern Europe (Balkan) and Greek highways	road	Car-to-X-Communication.	Communication of road vehicles via wireless LAN with other road vehicles or infrastructure facilities	Short range communication devices; base network			
4	DUT	Two Seas	Eastern Europe (Balkan) and Greek highways	Road		Conducted communication systems	Offers the driver detailed information about the traffic and weather situation as accurately, completely and rapidly as possible.	variable traffic signs, dynamic road control systems	Three bottlenecks on the segment have been foreseen up to 2030 (close to Florence, Rome and Naples)	Congestion, frequency, ICT applications, bottlenecks, fewer emissions.
5	DUT	Two Seas	Eastern Europe (Balkan) and Greek highways	Road		Traffic signalling optimization	Maintaining signalized intersections at their optimal performance for different demand conditions	Management SW for traffic light synchronisation and traffic improvements		Congestion, frequency, ICT applications, bottlenecks, fewer emissions.

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
6	DUT	Two Seas	Eastern Europe (Balkan) and Greek highways	Road		Broadcasting systems (TMC, TMCpro, TPEG, DVB, DAB).	These are system to broadcast and send traffic information to be integrated with NAVSAT for improved routing	Base network, on board equipment		Congestion, frequency, ICT applications, bottlenecks, fewer emissions.
7	DUT	Two Seas	Eastern Europe (Balkan) and Greek highways	Road		Mobile radio systems (GSM,SMS,GPRS,UMTS)	These systems feature communication on both broadcasting and dedicated info supply	GSM,GPRS,UMTS networks		Congestion, frequency, ICT applications, bottlenecks, fewer emissions.
8	NTUA	Two seas	entire corridor			remote monitoring of shipments and assets via GPRS technology / electronic tracking technology	arrival times, continuous inventory report	AGHEERA hardware and software components	Better scheduling and optimisation of fleet, as arrival times, and trackability improve. Better information to re-optimize production/ supply plans in real time. * Better order fulfillment rate to	fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									end customers Better information to re-optimize production/ supply plans in real time Decreased stock-in-transit for customer goods Better time-to-market for critical products Better information to re-optimize production/ supply plans in real time based on events in the supply chain Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
9	NTUA	Two seas	entire corridor	intermodal		real time tracking of containers with valuable loads / Sensor technologies / position data provided by GPS/data transmission via GPRS network	arrival times, continuous inventory report	SCHENKER SMARTBOX hardware and software components	Better scheduling and optimisation of fleet, as arrival times, and trackability improve. Better information to re-optimize production/ supply plans in real time. Better order fulfillment rate to end customers Better information to re-optimize production/ supply plans in real time Decreased stock-in-transit for customer goods Better time-to-market for critical products Better information to re-optimize production/ supply plans in real time based on	Fuel consumption, Asset optimization / Increase in productivity (throughput capacity of logistics networks), fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									events in the supply chain Reduction of insurance costs Secure Version with access-handling via USB plug & play technology	
10	DAP / NTUA	Two seas	Bologna-Roma	Rail		ERTMS-European Railway Traffic Management	Initiative to enhance cross-border interoperability and signalling procurement by creating a single Europe-wide standard for train control and command systems.	Balises, Interlocking, Traffic management system (ETCS Level 1 or 2)	Could bring improvement to traffic supporting interoperability	Reliability, ICT applications

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
11	DUT / NTUA	Two seas	Greek ports	…….	…… ….	FRETIS* as in Deliverable 4.1 (p. 9ff)	Cargo documents, tracking and tracing, landside container movements, information regarding the loading and unloading of vessels or trains, invoicing, etc.	XML, web-clients, Optical Character Recognition, client-server applications, WLAN	Extension of capacity	Increase of throughput, decrease in waiting times and enhancing competitiveness
12	DUT / NTUA	Two seas	Balkan railway network	rail		Traffic flow optimization by emkamatik	railway schedule	Optimization packages	coasting; reducing maximum speed; and lower grades of acceleration and deceleration (earlier braking and use of electric, regenerative brakes).	Energy economisation, fewer emissions.
13	NTUA	Two Seas	Entire corridor			anonymised sensor data gateway	Collect consumption emissions data	Relative sensors	Obtain information about emissions per individual vehicles	Environmental and economic attributes

Table 8 Main application areas for smart ICT systems at Two Seas corridor (2/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	MAR	Two Seas	Athens - Hamburg	Road		WiFi/WiMAX Traffic flow management, TDS	Information carrier	Communication equipment onboard and on shore Route planning, time Usable and easy to understand graphical user interfaces, easy available	Effective information exchange	Absolute and relative costs Reliability Service quality
2	MAR	Two Seas				Sensors (RFID/bluetooth etc.) Web/video camera veriwise	E.g. temperature, vibrations, movements,	Installation on equipment	Cargo monitoring	Service quality Cargo safety Transport time Reliability Congestion Cargo security Bottlenecks ICT applications
3	MAR	Two Seas		Rail		WiFi/WiMAX		Usable and easy to understand graphical user interfaces, easy available	Traffic monitoring, avoid congestions	Service Quality Reliability Transport time, fewer emissions.
4	NTUA/ SCH	Two Seas				Skymeter, Emission sensors			Emission/particle monitoring Greenhouse gases	Polluters Environmental Sustainability

6. Silk Way corridor

The Silk Way is a transport corridor using rail, short sea shipping and deep sea transport. The train service is not capable of transporting the same amount of goods in one shipment compared to a box vessel but the transport time is considerably shorter compared to deep sea transport.

The corridor consists of two main transport services linking the Far East with Europe. Today there are mainly two alternatives for shipping large transhipments of goods between the two regions, one being the deep sea service linking Shanghai to the Le-Havre-Hamburg region, while the other is the rail-link between Beijing and European Union.

The rail route runs through several countries between Beijing and European Union. The service is a regularly scheduled transport with a fixed route and departure days. The sea service is linking Shanghai to the Le-Havre-Hamburg region.

Silk Way is now possible to route across Kazakhstan which reduces the whole route by more than 1,000 km.

One route crosses the border from Russia into Latvia and leads through the Baltic Sea/Short Sea to Hamburg:

- Total distance: 5.806 km
- Time of transit: 10 days 20 hrs 46 min
- Average speed: ca. 30 km/h (534 km/day)
- Border crossings: Kazakhstan at Dostyk – Alashankou: 21 hrs 25 min, Russia at Petropavlosk: 4 hrs 28 min, Latvia/EU entrance at Zilupe: no information, Baltic sea at port of Ventspils

Next route crosses the border from Russia via Ukraine and Slovak Republic into the Czech Republic (Pardubice), final leg to Nuremberg:

- Total distance: 12,360 km
- Time of transit: 21 days 20 hrs 12 min
- Average speed: 21.5 km/h (516.7 km/days)
- Border crossings: Kazakhstan at Dostyk – Alashankou: 15 hrs 27 min, Russia at Iletsk: 6 hrs 40 min, EU entrance at Bryansk-Lgovsky/customs inspections: 3 days 13 hrs 50 min

6.1 Application Areas for smart ICT

The table below identifies potential Information and Communication Technologies (ICT) which can support the identified KPI's for the corridor. The table also identifies some other technologies which can contribute with information input to the ICT systems. Note that for the rail part of this transport corridor the information in Table is useful.

Visualization and presentation of information and data is crucial, and on board ships this is today mainly done in Electronic Navigational Charts (ENC) and ECDIS. Also all involved parties (rail carriers, related authorities, service providers) should have access to a common data (tracking and tracing) platform.

For communication, information and data exchange WiMAX is a viable alternative on land and within ports. As mentioned in previous section, WiFi and mobile systems are alternatives where WiMAX is not deployed. In coastal areas digital VHF is a good alternative for digital communication and information exchange. It has good range and about 128 kbps transfer capacity. Although digital VHF is a good alternative, it is deployed in very few sea areas in Europe. In areas out of reach for digital VHF the VSAT and Inmarsat are proper communication systems.

There is need for platform for routing and providing position data to planning and monitoring tools and this can be done by using GNSS (see also D2.5). However, in maritime transport there are also other systems that can be used, like Automatic Identification System (AIS), Long Range Identification and Tracking (LRIT), SafeSeaNet and Vessel Traffic Services (VTS) and weather reports. Web- and video cameras are important in monitoring applications.

As stated in D4.4 v2 there exist emission calculators that provide calculations for the maritime part of the Silk Way corridor, such as the Unifeeder calculator (for the distance Hamburg – Rotterdam), EcoCalc and the Maersk calculator for global calculations. One can assume that emission calculators will:

- raise awareness on greenhouse gas emissions, both for consumers, freight forwarders and ship/truck owners.
- Enhance transport companies "green profile”. This also would mean that they need to take actions and implement emission reducing technologies, and the total emission from the transport modes will be reduced.
- Also, by using the emission calculator, the customer has the opportunity to choose the most environmental friendly transport.

The entire railway line between Asia and Europe is fully electrified. The primary obstacle is that there are two gauge breaks. There are also delays from Russian gauges to European gauges when leaving Russia, caused by border crossings, inspections and different formalities. Also EU and CIS countries use different bills of ladings in rail transport. According to D4.4 results, in the Silk Way there is no implementation of ERTMS in the following sub-corridors and nodes: Hamburg-Berlin, Berlin-Warsaw, Warsaw-Minsk and Minsk-Moscow. In general ERTMS is a signalling system to enhance cross-border interoperability and use signalling equipment at Europe-wide standard. Its main objective is interoperability, and is not suitable for e.g. tracking of containers in real time. Probably an application of ERTMS (level 2 with GSM-R) inside terminals could not be applicable due to the cost of the system. The major influence of ERTMS on SuperGreen KPIs is expected to be on Transport cost, Transport time, Frequency, Reliability, Congestion/Bottlenecks, Traffic safety. The implementation of the ERTMS is very expensive, but in return it will allow more and faster trains on the line, and this will again influence the above-mentioned KPIs.

ERTMS main benefit is interoperability, which is the main objective of the system, this can make the rail network more competitive and it could move traffic from road to rail. In this sense one could have a reduction of CO2 or pollutant emissions (different modal split on the corridor). The implementation of ERTMS in Silk Way may have a direct positive effect on travel time (up to 50% reduction), hence also on the travel cost and the service frequency. Reliability and safety would increase because one has more real time information about rail traffic. There is also an indirect impact on emissions. Reduced travel time would reduce emissions of a single trip. However, ERTMS implementation would also allow for higher service frequency and higher efficiency. The generated new demand for rail transport in the corridor would result in more emissions.

Table 9 Main application areas for smart ICT systems at Silk Way corridor (1/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	MAR	Silk Way	Beijing - Hamburg	rail		ERTMS-European Railway Traffic Management EREX metering system				
2	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		AIS – Automatic Identification System LRIT – Long Range Identification and Tracking Radar SafeSeaNet	Vessel position, speed, ship ID, ETA, ETD, type of cargo	Transponder onboard ship (mandatory), on shore AIS infrastructure	Improved systems for port logistics and traffic monitoring, increases efficiency and safety	Absolute and relative costs Service quality Transport time Reliability Congestion Bottlenecks Cargo security and safety (AIS – hazardous cargo tracking), fewer emissions.
3	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		GNSS (GPS, Glonass, Galileo)	Position	GNSS receiver on board ship Not a specific ICT system, but is important input to ICT systems	Provide position to other systems	--
4	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		Port Community Systems	Time schedules, port resource	IT systems, sensors, web cameras	Port logistics, traffic monitoring, cargo tracking	Absolute and relative costs Service quality

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
						Single Window solutions	management, electronic information exchange (EDI), traffic statistics			Transport time Reliability Congestion Bottlenecks ICT applications
5	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		ENC/ECDIS	Maps	ENC or ECDIS bridge installations	Route planning	Service quality ICT applications
6	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		Broadband communication (WiFi/WiMAX, digital VHF...)	Information carrier	Communication equipment onboard and on shore	Effective information exchange	Absolute and relative costs Service quality
7	MAR	Silk Way	Shanghai-Rotterdam/ Hamburg	Deep Sea		Sensors (RFID/bluetooth etc.) Web/video camera	E.g. temperature, vibrations, movements,	Installation on equipment		Service quality Transport time Reliability Congestion Bottlenecks ICT applications
8	MAR	Silk Way	St.Petersburg-Hamburg	SSS		ShortSeaXML	These messages have been developed so far: Schedule, Booking, Manifest, Status. An invoice message will be available	ICT systems and applications which incorporates the ShortSeaXML standard Short Sea Shipping (SSS) implements mostly the same ICT systems as for Deep Sea. ShortSeaXML is however	Increase efficiency in transport related operations.	Absolute and relative costs Service quality Transport time Reliability Congestion Bottlenecks ICT applications

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							as soon as the UN Cross Industry Invoice message is ready.	developed specifically for SSS.		
9	DUT	Silk Way	St.Petersburg-Hamburg	SSS		Automatic Identification System (AIS) Exact AIS Satellite AIS	identifying and locating vessels (position, course, speed)	standardized VHF transceiver, positioning system such as a LORAN-C or GPS receiver, ship's navigational sensors (typically its global navigation satellite system (GNSS) receiver and gyrocompass)	High utilization, difficult navigability	Collision avoidance, managing ship traffic, aids to navigation, Accident Investigation
10	NTUA	Silk Way	Baltic Sea areas: -Gulf of Bothnia -Gulf of Finland -Gulf of Riga - others	SSS		An adequate ICT system could not be identified. It might be useful to establish a new system or to upgrade an existing system	Possibly: How to assign icebreakers to other vessels	Possibly: Use of already existing (communication)-technologies	Weather conditions constrain the full use of these sea areas	Reduction of waiting times, increase of throughput
11	NTUA	Silk Way	Baltic Sea harbors			FRETIS* as in Deliverable 4.1 (p. 9ff)	Cargo documents, tracking and tracing, landside	XML, web-clients, Optical Character Recognition, client-server applications, WLAN	Extension of capacity	Increase of throughput, decrease in waiting times and enhancing competitiveness

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							container movements, information regarding the loading and unloading of vessels or trains, invoicing, etc.			
12	NTUA	Silk Way	Entire corridor			anonymised sensor data gateway	Collect consumption emissions data	Relative sensors data gateway	Obtain information about emissions per individual vehicles	Environmental and economic attributes

Table 10 Main application areas for smart ICT systems at Silk Way corridor (2/2)

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					

1	SCH	Silk way	European legs (Germany and Poland)	rail		ETCS level 3		part of the ERMTS system based on GSM-R	This system in its latest/future development enables smooth border crossing and tracking control	
2	SCH	Silk way	rail corridor ex Asia	rail		GPS			Position of container Speed per day Transport time	
3	SCH	Silk way	rail corridor ex Asia	rail		Shock sensors Thermo sensors Noise sensors etc			Vibration Temperature Noise Intrusion Vibration Shock Doors open/closed Geo fencing Explosives Humidity	
4	SCH	Silk way	rail corridor ex Asia	rail		Logistics and planning tools. Weather reports			Gap to time table	Reliability
5	SCH	Silk way	rail corridor ex Asia	rail		bar code Unified transfer exchange on EDI messages Way Bill, invoices packing lists, status events			Unified transfer and exchange on EDI messages of Rail Way Bill, invoices, packing lists, status events between rail operators and customs authorities; unified use of bar code procedures to read documents automatically	
6	SCH	Silk way	rail corridor ex Asia	rail		Video supervision			Video supervision of the train in case of stops and unexpected events	

7. Edelweiss corridor

The Edelweiss corridor includes the nordic triangle railway/road axis extended to St. Petersburg and Moscow. In this corridor road, rail and sea are available for freight transport. States involved in this corridor are: Finland, Sweden, Denmark, Germany, Austria and Italy and they are characterized by continental and semi-continental climate in some case with oceanic influences. Especially Germany has established a polycentric network of high-speed trains.

The InterCity Express or ICE is the most advanced service category of the Deutsche Bahn and serves major German cities as well as destinations in neighbour countries. Demand for rail transport is expected to increase and enlarge the share of rail in freight transport in the EU.

The geomorphology situation is very diverse and includes fjords in Norway, lakes and islands in Sweden and Finland and hills and mountains in all these Countries. The landscape in these territories is full of forests and dominated by taiga.

Many road and rail projects are on-going in Sweden and Finland. These projects aim to improve the situation of the Nordic Triangle. For example many ongoing projects concern the areas near or in the big cities of Stockholm, Gothenburg, Malmo, Helsinki, the new high speed line Stockholm-Gothenburg and the improvement of road and rail connections from Helsinki to the Russian border. The expansion of motorway sections along the corridor is the main objective in terms of road transport.

Several ferry lines connect Denmark and Germany and the trip takes around 45 minutes. One major project to fasten and increase the capacity over the Fehmarn strait is the building of a tunnel and travel time will decrease to around ten minutes.

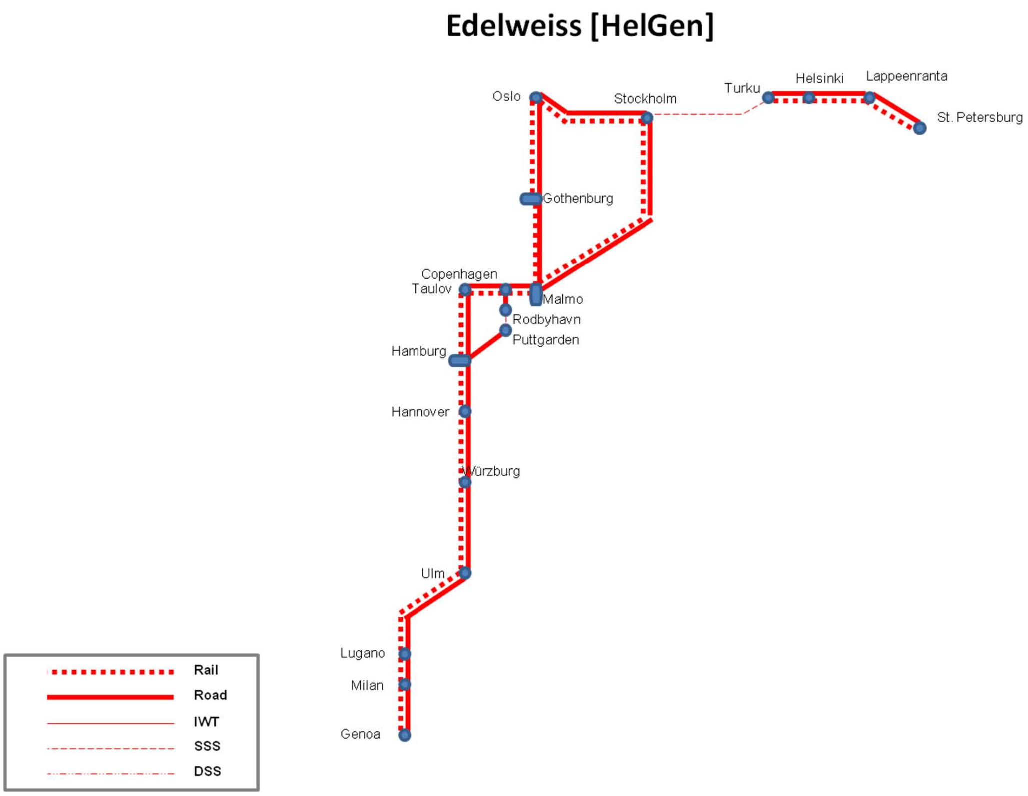

Figure 5 The Edelweiss Corridor

7.1 Application Areas for smart ICT

Several ICT technologies could be applied on the road network to improve the traffic regulation along the Edelweiss Corridors and especially in the segment between Copenhagen and Hannover via Hamburg. A major obstacle is that the infrastructure capacity along the corridor is limited on both road and rail. The Fehmarn strait between Denmark and Germany is also a major bottleneck.

The implementation of ERTMS on the Swedish parts of the Edelweiss corridor is running according to the Swedish Implementation Plan and in Finland ERTMS has progressed with GSM-R installations hence a wider ETCS (European Train Control System) implementation would further improve the situation (see also D2.5).

A system like AMV (Verkehrsmanagement Audio Mobil) can offer real time data, like the car position and speed, from the on-board application ASG (Anonymisiertes Sensordaten-Gateway). By real-time data it is possible to control traffic by adaptation of traffic lights and signs to the actual demand situation.

Technologies like the Conducted Communications Systems and Broadcasting Systems would help to make the driver more informed on the traffic and weather situations and to better organize the traffic regulation and improving the routing (GPS, Galileo and GPS Insight ICT).

Other specific equipment could be installed on the vehicles to provide information and communication to the drivers. These systems are supported by the GSM, GPRS and UMTS networks.

In areas with high traffic congestion solution as the Congestion charging system can be applied. This system is a system of surcharging users of a transport network in periods of peak demand to reduce traffic congestion. These systems can be used to reduce traffic congestion and reduce CO2 emissions.

There are interoperability problems on railways such as change of traction, different control, signalling and command systems hence integration and harmonisation of systems is a key issue.

CO2 emission sensors and dynamic electronic traffic signs can be used to reduce the displayed speed limit automatically, if the CO2 boundary value is exceeded. In Europe, a flexible speed limit depending on CO2 emission values was established for the first time in Tirol, Austria in 2007.

In the Baltic Area automatic environmental data collection sensors could be installed to record lane temperature, intensity of rainfall, solar radiation, humidity and wind direction in order to foreseen avoid accidents and to optimize the highway maintenance in the winter season.

Table 11 Main application areas for smart ICT systems at Edelweiss corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	DAP	EdelWeiss	Baltic Sea Area	Road		Road-weather-information systems (SWIS, AWEKAS, GFS Europa, Coupled general Circulation Models Eumesat Polar Systems (EPS)) are used to avoid accidents and to optimize the highway maintenance	Automatic environmental data collection sensors recording lane temperature, intensity of rainfall, solar radiation, humidity and wind direction.	Sensoring, base network Weather conditions like black ice or limited visibility in thick fog can be detected on time. Traffic computer centres control and coordinate the traffic guidance systems on the highway. They use the weather data and forecasts to display correct messages and speed limits on the electronic traffic signs and to coordinate the road maintenance. Less external costs, e.g. optimized salt usage in winter times	During hard winters, ice in the Baltic Sea might cause delays.	Congestion, frequency, ICT applications, relative cost

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
2	DAP	EdelWeiss	Motorways	Road		Speed limits on the highway depending on CO_2 emission values (VBA Umwelt Tirol)	CO_2 emission sensors and dynamic electronic traffic signs are used to reduce the displayed speed limit automatically, if the CO_2 boundary value is exceeded	sensors recording the traffic volume and the CO_2 emission	Could bring improvement to traffic supporting interoperability These technologies can be applied in each segment of the corridors involving roads transport. Their impact is more relevant in segments characterized by highest traffics volumes	Pollutant missions, congestion
3	DAP	Edelweiss	Motorways			Traffic signalling optimization		Variable traffic signs		
4	DAP	Edelweiss	Motorways			Intelligent Speed Adaption (ISA) Speed limiter	System that constantly monitor vehicle speed and the local speed limit on a road and implements an action when the vehicle is detected to be exceeding the speed limit.			
5	DAP	Edelweiss	Motorways			Toll amount depending on the pollutant category of the truck (German highway truck toll system)		pollutant sensors		

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
6	DAP	Edelweiss	Milan	rail		Caesar (or systems of individual operators like kombiverkehr, ökombi,…)	Provides times schedules for combined transport lines of the main combined transport companies in Europe from terminal-to-terminal	Seamless interfacing of information between the different players	Slot restriction foreseen in future due to conurbation	frequency
7	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		AMV Verkehrsmanagement Audio Mobil	Real-time car data (time, position, speed) from the on-board ASG (Anonymisiertes Sensordaten-Gateway) is transmitted to a computer (Clearingstelle) and formed into floating car data (FCD), it is made anonymous. By real-time data it is possible to control traffic by adaption of traffic lights and signs to the actual demand situation.		Improve the traffic regulation Currently the segment is dominated by traditional truck services with low use of information technologies	Congestion, ICT applications, pollutant emissions, fewer emissions.
8	DAP	Edelweiss	Copenhagen –	road		Conducted communication	Offers the driver detailed information	variable traffic signs, dynamic road control		

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
			Hamburg - Hannover			systems	about the traffic and weather situation as accurately, completely and rapidly as possible.	systems		
9	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Broadcasting systems (TMC, TMCpro, TPEG, DVB, DAB).	These are system to broadcast and send traffic information to be integrated with NAVSAT for improved routing	Base network, on board equipment		
10	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Mobile radio systems (GSM,SMS,GPRS,UMTS)	These systems feature communication both broadcasting and dedicated info supply	GSM,GPRS,UMTS networks		
11	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Innovative applications				
12	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Route Guidance systems Personal navigation assistant (Navigationssysteme)	NAVSAT for routing	GPS, GALILEO		

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
13	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Fuel- efficient route choice				
14	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Green trucks				
15	DAP	Edelweiss	Copenhagen – Hamburg - Hannover	road		Anonymised sensor data gateway				
16	DUT	Edelweiss	Ulm-Lugano	Rail		ERMTS / ECTS			Feeder routes to the alp-crossing axes Implementation obstacles especially with cross-border operation with Switzerland	
17	DUT	Edelweiss	Ulm-Lugano	Rail		ECTS /ERMTS Or at least facilitating interoperability with Swiss signaling systems			The two alp-crossing axes “Gotthard” and “Lötschberg-Simplon” Main challenge in this segment of the EdelWeiss corridor is crossing the Swiss Alps. Especially the feeder routes to the	

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									two alp-crossing axes are bottlenecks as well as cross border operations with Switzerland	
18	NTUA	Edelweiss	Entire Corridor			Anonymised sensor data gateway Skymeter	Collect consumption emissions data	Relative sensors sensor data gateway	Obtain information about emissions per individual vehicles	Environmental and economic attributes
19	DAP	Edelweiss	motorways	Road		Expert charging ICT	Electronic toll collection system for trucks over 3.5tonnes based on: distance covered, weight and type of vehicle (as already applied in Austria and Germany)		Highways congestion (the systems could help to encourage modal shift and reduce road congestion)	Modal shift from road to rail, helps the reduction of CO_2 emissions.
20	DAP	Edelweiss	Motorways	Road		Braking Assistant Systems (BAS)	It is a power brake unit attached in a vehicle that increases the pedal pressure up to the possible maximum of braking pressure in an emergency situation.	Power brake unit attached in the vehicle	Improve the safety of vehicle and people	Quality of life
21	Dap	Edelweiss	Motorways	Road		Telogis Route ICT	It is a Multi-vehicle route optimization tool for both strategic	Web-based Software-as-a-Service (SaaS)	Traffic congestion, improvement of efficiency, reducing	Efficiency, traffic congestion,

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
							and tactical resource planning. Telogis Route provide visibility in routing costs and an instant feedback on route plans..		of costs	reduction of costs
22	Dap	Edelweiss	Motorways	Road		GPS Insight ICT	The system provides insight via real-time maps, vehicle location lists, alerts, graphs, messages, landmark visits, schedule reports, set up alerts or administer vehicle and driver.		Reduce fuel consumption and CO2 emissions	Reduce fuel costs Improve productivity
23	Dap	Edelweiss	railways	rail		TAF TSI ICT	TAF-TSI is a system integration project undertaken by the European rail freight industry. The project is based on harmonised business processes supported by standardised.		Reduction of costs, improving standardisation,	cost-effective
24	Dap	Edelweiss	railway	rail		RAILTrack ICT	It is a solution, providing rail terminals of any size		Reduction of the tco (total cost of ownership);	Cost reduction, productivity

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
							with all the required planning, operational and management tools their business requires.		improving productivity,	

8. Finis Terrae corridor

Finis Terrae corridor is linking the Iberian Peninsula to mainland Europe. Countries involved are Portugal, Spain and France. The corridor typically handles cargo from the western part of the Iberian Peninsula (Madrid/Lisbon), into Paris and towards central Europe, including the Benelux and Ruhr region.

The Finis Terrae corridor supports road, rail, inland waterway, short sea shipping and various combinations of these transportation modes but mainly the freight traffic is running by road or by sea and only approximately 2% of goods is being transported by rail.

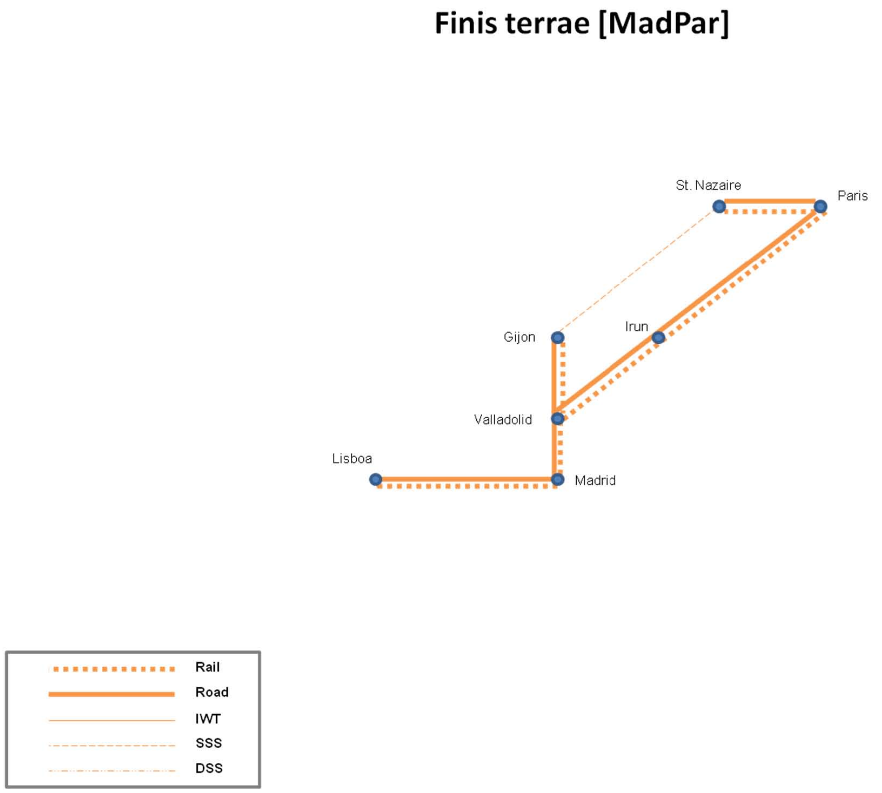

Figure 6 The Finis Terrae Corridor

8.1 Application Areas for smart ICT

VTMIS could help to overcome some main obstacles for sea transportation at Finis Terrae such as congestion, and safety and security. The various administrative bottlenecks and transit time could be decreased and on the other hand reliability, safety & security could be enhanced.

The Agheera system could once more help improving reliability and physical bottlenecks. The monitoring of cargo is essential through the transportation chain to arrange delivery and improve programming and scheduling of cooperative modes. This could reduce congestion and transit time and indirectly also reduce emissions over the transportation chain.

In the corridor there are many obstacles related to physical limitations (road capacity or geographical barrier of the Pyrenees) but operational bottlenecks are related to interoperability issues of between Spanish and French railways systems. The ERTMS (European Railway Traffic Management System) could solve many problems in the new rail lines under construction where the journey times will be reduced by 60 %. In fact the installation of ERTMS in the new high speed rail connections will minimise obstacles in cross-border areas, change of traction, different control, signaling and command systems and improve the competitiveness of rail transport in the corridor. ERTMS is not yet implemented in Finis Terrae segments. However Paris-Irun, Irun – Valladolid – Madrid and Madrid Lisbon are segments where ERTMS should be implemented by 2020 based on the European Deployment Plan for ERTMS. Train control systems, as ERTMS, are implemented to ensure safe rail traffic. There exist nowadays more than 20 incompatible systems all over Europe. To ensure interoperability normally trains for international lines are equipped with several control systems in parallel. ERTMS is designed to enhance the nationwide interoperability, harmonize railway operations and replace the current control systems. This leads to reduced costs for traction units, for they have not to be equipped with several systems or to time savings, because no goods have to be transshipped or wagons have to be equipped with other traction units.

EREX is a metering system proposed by ERESS (European Partnership for railway energy settlement systems) and can help minimizing emissions. EREX provides an efficient, reliable, accurate and flexible energy settlement process. This enables EREX partners to fulfil requirements for a neutral and non-discriminatory operation, and railway undertakings to understand their use of energy and thereby save energy and costs. EREX provides the opportunity to measure energy consumption and thus also the possibility to reduce it. Increased cross-border rail operations requires the use of different energy suppliers. An energy settlement system helps Rail, as a documented example, the Norwegian national railway (NSB) started an energy-saving project in 2005 based on measured energy data. Between 2004 and 2010 the energy efficiency was improved with 18%. This project has thereby allowed NSB to achieve substantial cost savings. Similar results are expected by implementing EREX in the Finis Terrae corridor.

Last the deployment of JUP, VTMIS and Optimar have been identified as an important possiple application areas for the Finis Terrae corridor. An innovative single window application ICT such as JUP will help smothering the operations in terminals and the corresponding transportation modes in Gijon – Saint Nazaire segment of the corridor. Major bottlenecks here are the administrative issues that consume a lot of time and resources. The single window application JUP is suitable to solve all present administrative bottlenecks and also solve reliability and safety and security issues. Other beneficiary transportation modes from JUP could be road and rail. JUP is a web platform interconnecting the different players working at the ports. The objective of these systems is to enable electronic clearance of ships and cargo resorting to one single window in the port and thereby to simplify and ease the necessary procedures. There are plans to use JUP in Lisboa on the Finis Terrae corridor and only for port processes that are relevant.

Optimar will help minimise transport Cost, transit time, congestion, and fewer emissions in modes involved in the Finis Terrae corridor.

A similar concept could be implemented via JUP (possibly as a separate module) is what is known as "virtual arrival." By this one means the voluntary slow down of a vessel's speed to arrive at a port later than the full speed time and avoid congestion. It is clear that significant quantifiable benefits can be achieved in a maritime or intermodal corridor's KPIs by appropriate implementation of such a system, and use of ICT is critical in that regard.

The segmentarion of this corridor is as follows:

Table 12 Segmentation at Finis Terrae corridor

Segment	Nodes	Comments
S1	Lisbon - Madrid	There is a delay from 2012 to 2016 in the portuguese side of the HighSpeed Rail service (HSR) under construction, due to economic restriction
S2	Madrid - Gijon	Therere are a small delay of 1-2 years in the 2 tunnels in Asturias and Madrid, for the mixed service cargo & passenger of HSR service
S3	Gijon – Nantes :	The MOS service alreade started in September 2010 and in June 2011 the vessel was changed by a larger one to cope to high transport demand from both passengers and trucks.
S4	Nantes - LoD	The MODALHOR Rail Service connecting the Port and the Truck & Container Terminal is in service.
S5	LoD - Paris	The ·"last mile" conection with Paris is made mainly by trucks
S6	LoD - Brussels	The „last mile" connection with Brussels is made mainly of trucks and rail

Table 13 Main application areas for smart ICT systems at Finis Terrae corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	PSAS/ PAG	Finis terrae	Gijon – saint nazaire	SSS	Rail, road	VTMIS/VTS	VTMIS/VTS ETD / ETA Weather forecast info CO2 & GHG emissions	VTMIS/VTS Internet, GPS / GALILEO, ECDIS, AIS	Decrease Congestion, improve safety & security conditions, Obtain information about emissions per individual vehicles	Transit time, reliability, congestion, admin bottlenecks, safety & security, fewer emissions. Reduction of waiting time at Ports, compliance with the requirements for traffic safety, and compliance with the environmental requirements
2	PSAS	Finis terrae	All	All		RFID, smartbox, veriwise	Cargo identity, movements	RF sensors, RF readers, e-tags, e-seals	Enhance Reliability, solve admin bottlenecks	Minimization of Cost, reduction of transit time, increase reliability and solve admin bottlenecks
3	PSAS	Finis terrae	Gijon – saint nazaire	SSS		TOS	Cargo movements	TOS system components and compatible ICTs	Minimise Cost, overcome physical bottlenecks, admin bottlenecks	Decrease Cost and transit time and congestion, fewer emissions.

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
4	PSAS	Finis terrae	Gijon – saint nazaire	SSS	Rail, road	JUP Single window application	Cargo data, movements, cargo ETA, admin information	JUP system components and compatible ICTs	Improve Reliability, minimise admin bottlenecks, increase safety & security	Cost, transit time, reliability, congestion, admin bottlenecks, safety & security, fewer emissions.
5	PSAS	Finis terrae	Gijon – saint nazaire	SSS	Road	SSD	SSD	SSD system components and compatible ICTs	Cost, reliability, congestion, physical bottlenecks, admin bottlenecks	Cost, transit time, reliability, admin bottlenecks, fewer emissions.
6	PSAS	Finis terrae	All	All		AGHEERA veriwise	Cargo origin destination data, real time tracking & movements	GPS sensors, GSM platform, temp, shock and light sensors.	Increase Reliability, overcome physical bottlenecks and admin bottlenecks, improve safety & security	Cost, reliability, physical bottlenecks, admin bottlenecks, safety & security
7	PSAS	Finis terrae	All	All		OPTIMAR	Vessel movement, OD data	OPTIMAR system components and compatible ICTs	Cost, transit time, congestion	Cost, transit time, congestion, fewer emissions.
8	PSAS	Finis terrae	Gijon – saint nazaire	SSS	Rail, road	SHORTSEAXLM	Cargo data and movements	SHORTSEAXLM platform and compatible ICTs	Increase Reliability, solve admin bottlenecks, improve safety & security	Cost, transit time, reliability, Admin bottlenecks, safety & security

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
9	PAG	Finis terrae	Lisbon Madrid	Road (Rail in 2015 +)		RMS - ERTMS Traffic Management EREX	Requested time of arrival (RTA), estimated time of arrival (ETA) CO2 & GHG emissions	Internet, GPS / GALILEO systems	Different rail gauge Spain-Portugal Obtain information about emissions per individual vehicles	Reduction of waiting time at Ports
10	PAG	Finis terrae	Madrid - Gijon	Road (Rail in 202015+)		RMS - ERTMS Traffic Management EREX	Requested time of arrival (RTA), estimated time of arrival (ETA) CO2 & GHG emissions	Internet, GPS / GALILEO systems	Delays in the new tunnels for HSR services connecting Madrid – Gijon Obtain information about emissions per individual vehicles	Reduction of waiting time at Terminals
11	PAG	Finis terrae	Nantes – Lomme ou Dourge	Rail	…… ….	ERTMS EREX	Requested time of arrival (RTA), estimated time of arrival (ETA) CO2 & GHG	Internet, GPS / GALILEO systems	Propietary Stand-alone rail system from MODALHOR Obtain information about emissions per individual	Reduction of waiting time at Terminals

No.	**Partner**	**Corridor**	**Segment or transport chain**	**Transport Modes**		**Specific ICT technology**	**Data / Information**	**Installation Requirements (technology, software, data)**	**Bottleneck / Motivation**	**Related KPIs or Attributes**
				Major Mode	Other Direct Beneficiary Users					
							emissions		vehicles	
12	PAG	Finis terrae	LoD Paris	Rail & Road		RMS - ERTMS Traffic Management EREX	Requested time of arrival (RTA), estimated time of arrival (ETA) CO2 & GHG emissions	Internet, GPS / GALILEO systems	Different toll systems in France, Communication problems Obtain information about emissions per individual vehicles	Reduction of waiting time at Terminals
13	PAG	Finis terrae	LoD Brussels	Rail & Road		RMS - ERTMS Traffic Management EREX	Requested time of arrival (RTA), estimated time of arrival (ETA) CO2 & GHG emissions	Internet, GPS / GALILEO systems	Different toll systems in Belgium Obtain information about emissions per individual vehicles	Environmental and economic attributes
14	NTUA	Finis terrae	Entire Corridor			Anonymised sensor data gateway Skymeter	Collect consumption emissions data	Relative sensors sensor data gateway	Obtain information about emissions per individual vehicles	Environmental and economic attributes

9. Strauss corridor

The Strauss corridor crosses Europe transversally from the North Sea at Rotterdam to the Black Sea in Romania.

The corridor length is approximately 3500 km and that makes it one of the longest in the Trans European Transport Network. The corridor and crosses the European Union countries of the Netherlands, Belgium, Germany, Austria, Slovakia, Hungary, Romania, and Bulgaria and many non EU ones like Croatia, Republic of Serbia, Moldova and Ukraine.

The Meuse and the Rhine rivers are the entrance gates for the Belgian and the Dutch inland waterways to this Priority Project corridor. The main cargo types transported on the Rhine-Main-Danube axis are dry bulk, liquid bulk, high value goods and containers. Through the Main River and the Main-Danube Canal, the Rhine River is connected to the Danube that flows until the Black Sea. The main commodities transported on the Danube are: traditional bulk cargo e.g. iron ore (83 %), medium-value cargo e.g. steel or construction materials (15 %) and high-value goods e.g. vehicles or manufactured goods in containers (2 %).

An FP7 EU project PLATINA the Strategic Research Agenda for Inland Waterway Transport was elaborated in agreement with major representatives of the European inland waterway transport sector, describing the sector specific research and development needs.

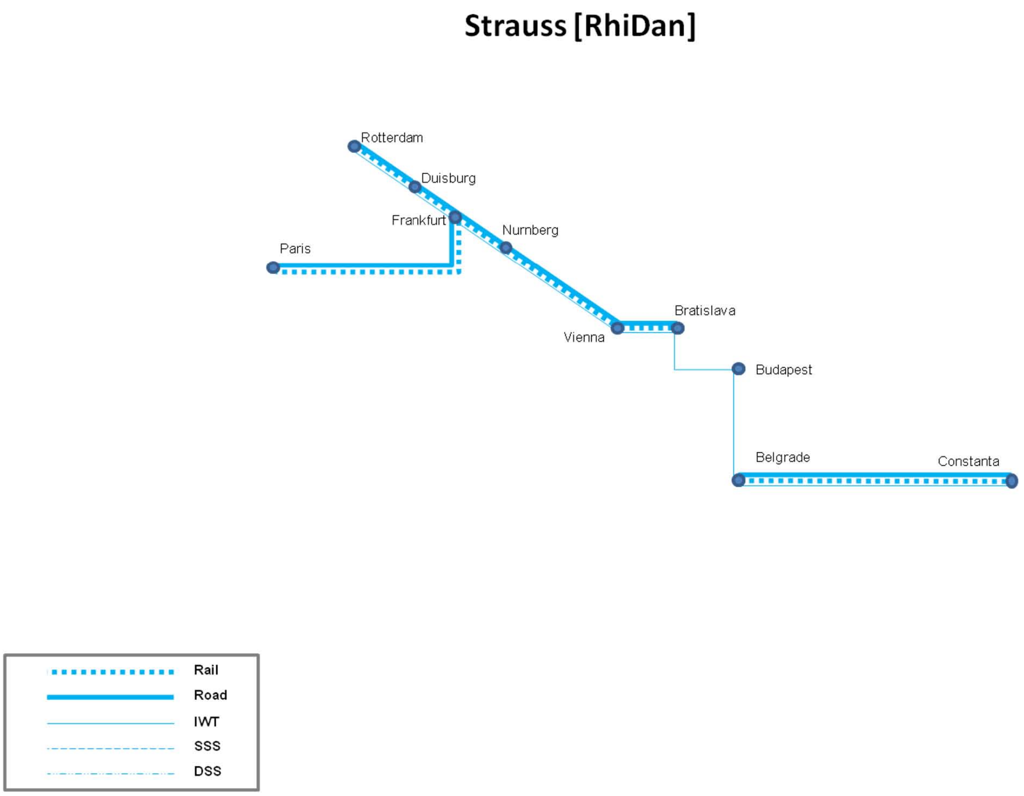

Figure 7 The Strauss Corridor

9.1 Application Areas for smart ICT

Terminal, lock and bridge capacities.
The bottlenecks with the highest amount of waiting times in inland navigation are at terminals, locks and bridges. One major bottleneck for example along the Rhine/Maas-Main- DanubeSTRAUSS corridor relates to insufficient lock capacities on the river Meuse exemplary in the Belgian- Dutch section and therefore presents the first application area. This bottleneck does not hinder navigation, but a removal of this bottleneck would improve significantly the transport performance of inland navigation. Also some border crossing delays are present due to lack of harmonisation of procedures with non-EU countries.

The River Information Service (RIS) contributes to solve this problem. For example the RIS service, named Traffic Management (TM), could be applied [SUP11]; [RIS11]. TM is carried out by waterway administrations aiming at optimal utilization of the infrastructures and assurance of safe navigation. TM comprises three complementary components, Local Traffic Management, Navigational Support and Lock and Bridge Management. Similar to TM the RIS service, named Information for Transport Logistics, would enable a better slot management. This RIS contains apart from the components Voyage Planning (VP), Transport Management (TM) and Cargo and Fleet Management (CFM), especially the component Intermodal Port and Terminal Management (PTM). An attribute, which would be significantly improved due to the application of for example one of the named RIS, is the significant reduction of waiting times. RIS collects the position data of the different vessel on the rivers and lock, bridges and terminal operators are able to plan their time frames for the vessels. The knowledge of upcoming Required Times of Arrival to the individual skippers allows them to keep their speed more homogenously, which therefore reduces the fuel consumption.

Lock operators can inform the individual skipper of his RTA [Requested Time of Arrival], enabling him to adapt his speed and possibly save on fuel. As a result the trans-shipment time can be reduced. Better slot management is possible as a result of the exchange of ETA [Estimated Time of Arrival] and RTA.

Fairway conditions

Another major bottleneck along the corridor is in some places the water depths on the Danube, which therefore forms the second application area. Exemplary in the German section a provision of water depth of 2.5m at Straubing- Vilshofen or in the Austrian section a provision of 2.8m south of Vienna would improve the navigation conditions significantly.

Here RIS and its Fairway Information Service (FIS) could be used to ensure a better information flow and to improve the planning process. [RIS11] . FIS contains geographical, hydrological and administrative data. It provides dynamic as well as static information about the use and status of the inland waterway. FIS will provide standardised electronic charts and standardised notices to skippers in a machine readable format and in eleven languages. But FIS contains data on the waterway infrastructure only – excluding data on vessel movements – and therefore consists only of one-way information from shore to ship/office.

An alternative in this context could be Statistics (ST). This is an electronic data collection that contains relevant inland waterway freight statistics. It will facilitate the process for data providers and statistical offices. With this information skipper are able to work with actual an accurate data about infrastructure and fairway conditions.

Communication interferences at borders

The navigation conditions for example at the Romanian-Bulgarian border are another problem due to communication interferences. To solve this problem the RIS feature, named Information for Law- Enforcement (ILE), could be helpful. It would enable the companies to meet the local requirements regarding traffic safety and environmental issues more easily and it can ease the communication and therefore reducing the waiting times at the borders

Communication at ports

The forth application area are the ports in general since they are a major bottleneck along the corridor. Existing port systems are based on manual input, for example the manual transfer of files or in most cases stand alone systems. These aspects might lead to erroneous input. In those cases the FIS would be suited as well. It would increase the intermodal efficiency on the whole transport chain.

Toll systems

Equally the toll systems in general are a problem in the maritime sector along the corridor and hence are the fifth application area. Different toll systems in Europe and different languages complicate the communication and information flow. Waterway Charges and Harbour Dues (CHD) have to be mentioned in this context. RIS can assist in levying charges for the use of infrastructure tolls. The travel data of the ship can be used to automatically calculate the charge and initiate invoicing, thus facilitating the process for waterway users and authorities.

Advantages and Disadvantages of RIS

As a disadvantage of RIS can be seen, that the measurement of reliable quantitative effects of RIS is very difficult as it deals with many different actors and as statistical data are very rare. Another difficulty is the different timeframe of introducing RIS and that different features of RIS probably are introduced in different speed. So they are not all available on the whole corridor.
But when the major features of RIS are implemented, the benefits can be summarised in:

- increased competitiveness,
- optimised use of infrastructures,
- improved safety and security and
- increased environmental protection and energy efficiency.

Table 14 Main application areas for smart ICT systems at Silk Strauss corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	DUT	Strauss	Meuse, Belgian-Dutch section	Inland waterways		River Information Service (RIS) -Traffic Management	Requested time of arrival (RTA), estimated time of arrival (ETA)	Internet, satellite positioning systems, electronic chart and display information systems, automatic identification systems etc	insufficient lock capacities	reduction of waiting times, fewer emissions.
2	DUT	Strauss	Danube, German section and Austrian section	Inland waterways		RIS-Fairway Information Service (FIS)	geographical, hydrological and administrative data, information about the use and status of the infrastructure		water depths on the Danube, 2.5 m at Straubing-Vilshofen (Germany), 2.8 m south of Vienna (Austria)	
3	DUT	Strauss	National Bulgarian/ Romanian border	Inland waterways		RIS-Information for Law-enforcement (ILE)			Navigation conditions, Communication interferences at the border	Reduction of waiting time at borders, compliance with the requirements for traffic safety, and compliance with the environmental

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
										requirements
4	DUT	Strauss	Ports in general in the maritime sector			RIS-Fairway Information Service (FIS)			Non-electronic communication or stand-alone systems at the ports	
5	DUT	Strauss	Toll systems in general in the maritime sector	Inland waterways		RIS-Waterway Charges and Harbour Dues (CHD)	travel data, calculate the charge and initiate invoicing		Different toll systems in Europe, Communication problems	
6	NTUA	Strauss	Entire corridors	All		anonymised sensor data gateway	Collect consumption emissions data	Relative sensors	Obtain information about emissions per individual vehicles	Environmental and economic attributes

10. Nureyev corridor

The Nureyev corridor includes a short sea shipping route connecting Russia to Europe, as well as land based routes to and from ports at each end. During the winter especially in the Northern part of the corridor ice conditions can be rather difficult. The ice conditions are often difficult and last usually 2–3 months, during harsh winters even longer. The length of the corridor is 4,500 kilometre and all countries around the Baltic Sea are involved. The biggest ports along the corridor are Helsinki, St. Petersburg, Gothenburg, Hamburg and Rotterdam including also the vast metropolitan area of Moscow. The connections from / to ports are generally in a good level.

The Baltic Sea has some special characteristics by the nature like the fact that it is quite small and shallow with an average depth of 55m and the inflow by the North Sea is narrow therefore water stays quite long in the Baltic Sea before it is replaced by new water from the North Sea. IMO (International Maritime Organisation) is setting new quality requirements for maritime fuels and in Baltic Sea this would mean cutting the sulphur content of ship fuel to 0, 1% by 2015 (currently the cap is 1, 5%) and the new regulation can also lead to back shift from sea to road and by that completely reverse the environmental perspective.

The traffic volumes in the Baltic Sea are estimated to grow rapidly and especially the oil transportation from Russia. It is estimated that the rail network between Klaipeda and Minsk is approaching its capacity. An upgrading project aims to improve the infrastructure and allows the speed of 160 km/h.

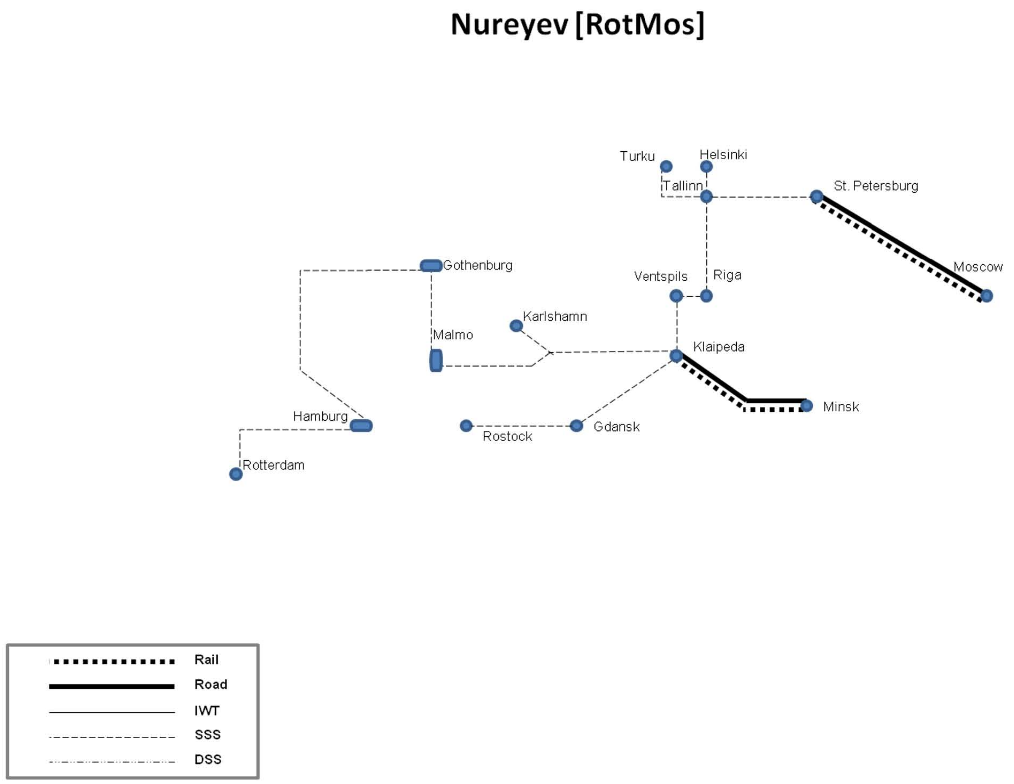

Figure 8 The Nureyev Corridor

10.1 Application Areas for smart ICT

Transportation within the Baltic Sea corridor “Nureyev” is coined by special conditions by the nature of this corridor and therefore faces several challenges.

The Baltic Sea was declared to be a Particular Sensitive Shipping Area (PSSA) by the International Maritime Organization (IMO), which means that the Baltic Sea is considered to be an “area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific reasons and which may be vulnerable to damage by international maritime activities” [IMO10].

Concerning transportation the Baltic Sea is considered to be one of the most heavily travelled seas in the world, being responsible for up to 15% of the world`s cargo, which in other figures says that there are at least 3,500 ships in the Baltic marine area at any given moment [HEL10].

Generally speaking, traffic in the Baltic Sea is characterized by risks coming from the relatively large amount of hazardous goods being transported as well as risks coming from the high usage rate of shipping routes and difficult navigation conditions.

The first application area that can be identified, are the shipping routes in the Baltic Sea. Due to high traffic and the narrow straits (e.g. the Skaw) some shipping routes are very busy. Main shipping routes in the southern and eastern part of the Baltic Sea with potential hazards are [BAL10]:

- The Danish Straits
    - Navigation through the Danish Straits (including the Skaw(Skagerrak), Kattegat and the Great Belt (Storebælt) is risky due to the shallow depths
    - The Danish Government established a transit route, called Route T between Skagen (the Skaw) and the area north-east of Gedser, with a minimum depth of 17 meters to ensure safe deep draught vessel traffic
- Kaddet Trench (German: Kadetrinne, Danish: Kadetrenden)
    - Sea area between the German island “Fischland-Darß-Zingst” and the Danish island “Falster” with a minimum depth of 15 meters
    - Depending on the ships draught the navigational routes width is reduced to 500-1.000 meters
    - 63.000 transits per year with about 9.000 transits of tankships (figures:2006)
- Route North of Bornholm (Danish Island)
    - Recommended for all deep draught vessels
- Route South of Bornholm/East of Ruegen
    - Possible for deep draught vessels to navigate in, but also restricted by shallow depths (Orla Shallow, Odrzana Shallow (6 meters) and Slupska Shallow (8 meters)

There are TSS (Traffic Separation Schemes*) and other ships routeing measures implemented in order to ensure safe navigation.

Especially the so-called AIS (Automatic Identification System) was implemented to improve traffic safety in the Baltic marine area. “The Automatic Identification System (AIS) transmits geographical and identification data to and between ships, facilitating safe passage and readiness in changing sea conditions. The system provides a cohesive picture of sea traffic in the area. It helps ships anticipate the behaviour of surrounding traffic, […]” [VTT10]. Keeping in mind that this is a major achievement in maritime traffic safety the AIS system’s history in the Baltic Sea is quite short (starting in 2005) [HEL08].

Given the still high accident rate, it might be interesting to analyze the existing ICT system AIS in order to detect space for improvements. Possible improvements are the communication between ships, the ability for users to make good use of given information, etc.

** Traffic-management route-system ruled by the IMO. The traffic-lanes (or clearways) indicate the general direction of the ships in that zone.*

But still there are still bottlenecks to solve, like improvement of the communication between ships and the ability for users to make good use of given information, etc.
_The ICT system ENSI (Enhanced Navigation Support Information) provides there some useful applications. ENSI lets vessel traffic controllers know about the route plans of vessels as they can check the route plans in advance and intervene in possible hazardous situations. Example of its application is Gulf of Finland, where ENSI works in conjunction with GOFREP (Gulf of Finland Reporting) and VTS (Vessel Traffic Service). In Nureyev corridor this means that the ICT is applied in the following segments:

- Helsinki – St. Petersburg
- Helsinki – Tallinn
- Tallinn – Turku

The route plan in a digital form is sent to the VTS where it is checked with the help of the computer.

The further application areas also concern the Baltic Sea shipping routes. So the Gulf of Bothnia (with Bay of Bothnia and Sea of Bothnia) was identified as a second, the Gulf of Finland as a third and the Gulf of Riga as a fourth application area. These bottlenecks also hold risks for traffic safety but are made up by weather conditions. During the winter periods parts of the Baltic Sea are covered by ice. Especially the Gulf of Bothnia (Bay of Bothnia, Sea of Bothnia), the Gulf of Finland and the Gulf of Riga are impacted by ice. Other areas can also be affected by ice, but the consequences are usually not severe.

Weather ice conditions can present a serious danger to ships and therefore to the whole ecosystem. Furthermore a severe cold affects the ships speed (reduction in average almost by half), results in an increase in fuel consumption and in an increase in harbour costs.

In order to ensure safe traffic during icy periods several restrictions are issued. These restrictions mainly say that only ships with special assets (such as a minimum engine power, a certain hull quality or even a certain “ice class”) are allowed to navigate within iced sea areas. Other ships that do not meet the issued specifications are dependent on icebreakers for assisting their travel. In the ice season 2008-2009 2432 vessels received assistance from more than 20 icebreakers being in operation at once at maximum. In the latest season only minor damages occurred. This relates to the fact that this season is considered to be a mild one. According to the figures of 2003 (winter navigation season 2002/2003 was especially difficult) about 100 vessels reported damages due to the severe ice conditions.

It is imaginable, keeping in mind that about 20 icebreakers were responsible for about 2400 assisted transits in the whole Baltic marine area, that traffic flow was at least restrained. Possible outcomes are waiting times and additionally higher costs. Furthermore it seems possible that an ICT system could facilitate the process of assigning icebreakers to vessels. The chance of a new system could be the uniform integration of all icebreaking units in the Baltic Sea, addressing all Baltic Sea states to overcome peaks and concentrate the icebreaking forces in crucial areas. It also might be possible to relate resulting costs to rendered services making them more transparent or relating them to the causer.

On possible ICT system here is called IBNet (Icebreaker Net). It is a computerised information and management system used by the Swedish and Finnish icebreaking services and it contains highly useful information to the icebreakers in their day-to-day assistance operations. It contains registries of merchant vessels, the positions of all vessels, port information, current traffic restrictions, etc. and facilitates allocation of icebreaking resources.

IBNet works over mobile connections and the data transfer is based on satellite systems. It utilizes satellite images, weather and ice forecasts for presenting and predicting the changes in the ice conditions. The vessels have AIS equipment which imparts information to IBNet about vessel speed, direction, draught and power. All icebreakers in Finland and Sweden have to have IBNet system in place.

The Finnish Meteorological Institute (FMI) and the Swedish Meteorological and Hydrological Institute (SMHI) are able to access icebreaker reports on ice and weather conditions via IBNet. SMHI uses this information as one of its sources of input for issuing ice forecasts, which are also distributed via IBNet. FMI transmits satellite images almost every day which can be presented along with icebreaker and ship positions.

The icebreakers enter information on traffic in their own districts. The information is transmitted automatically to the Icebreaking Management Unit and to other Finnish and Swedish icebreakers. By combining ice condition information with real-time sea traffic information, IBNet offers valuable background information for coordinating the icebreaker fleet. IBNet's distributed architecture with asynchronous replication ensures the usability of the system in all conditions. Local reporting and information retrieval is enabled even in cases when the communication connections are temporarily broken.

IBNet also provides statistics reports that enable follow-up of how the icebreaker fleet has operated and provides tools for controlling and improving the service level of the icebreakers. IBNet is used as a decision support system on the icebreakers and at the coordinating centres in Finland and Sweden. In the icebreaking co-operation of these countries IBNet plays a central role as the operative tool for maintaining and developing the service level of the icebreakers on the Baltic Sea.

IBPlott is an extension module of IBNet, providing a graphical map-based presentation displaying the traffic situation on top of satellite images and ice charts. Up-to-date satellite images, weather and oceanographic data are displayed together with AIS-based (Automatic Identification System) real-time traffic situation in a zoomable and pannable window. IBPlott supports presenting many images at the same time. Routes can be drawn and vector-based coastlines can be shown over the images.

The biggest advantage of the system is more effective coordination of the icebreaker fleet. Waiting times caused by severe ice situation can be minimized, optimal number of icebreakers is constantly in use and fuel costs can be saved. Route planning is done in an optimal and in cost effective way. IBNet has also made it possible to give up the expensive helicopter intelligence. But IBNet is not available on the whole Nureyev corridor.

The fifth application area is concerned with the nodes of the corridor mainly with the harbours of the Baltic Sea. There are significant waiting times in the harbours caused by administrative issues. Additionally the capacity and the coordinated use of the main bottlenecks are an important time factor at the harbours.
The Dutch consulting agency Dynamar recently published their forecast "Container Throughput & Terminal Capacity in Europe 2010". According to this document the Hamburg-Antwerp range harbours will not face capacity bottlenecks at least until 2020.

Their capacity utilization will only increase up to 61 percent until 2020. The Baltic Sea harbours however will be confronted with a greater increase in the next ten years. Their capacity utilization will rise from about 54% by almost 30% up to crucial 83%. Especially the port of Göteborg can profit from the rise in traffic volume [DVZ10a] [DVZ10b]. However this pleasing development for the Baltic Sea harbours also creates a capacity bottleneck and will most likely result in approaches to extend present capacities physically. This is often the only way to meet the increasing demand, but also means an interference with nature and therefore results in a change in ecological conditions. In order to minimize the impact of the extension of capacity it also seems to be reasonable to increase capacity in terms of improving the existing port ICT systems.. Faster operations at the ports would allow fastening the whole transport chain and to increase the competitiveness.

To close the bottleneck of administrative and planning processes in the harbours there are different ICT systems possible to implement, which here are called e-administrative ICT.

The Maritime/Port ICT systems given in Deliverable 4.1 show ways and means to facilitate and speed up operations: Two e-administrative ICT are explained in the following: FRETIS and Single Window system:

The Freight Transport Information Technology Solutions (FRETIS) is an ICT system for medium sized container terminals for container terminal management [DEV10]. FRETIS is based on 11 modules; The Central Information Management Platform a relational database management framework is the backbone of the whole system and simplifies the dynamic merger of all applications. It offers next to others information and management tools and document and invoicing applications for the port. But FRETIS is not yet introduced in the Nureyev corridor.

Single Window is a system that allows parties involved in transport to lodge standardized information and documents with a single entry point to fulfil all import, export, and transit-related regulatory requirements. Single Window environment provides one point for the submission and handling of data and documents related to an international transaction. It is managed by one agency which informs the appropriate agencies and directs combined controls. It eliminates the need for the trader or transporter to submit the same data to several occasions. The Single Window environment aims to expedite and simplify information flows between trade and government and bring meaningful gains to all parties involved in cross-border trade.
The European Commission is highly committed to this approach and actions have been taken in order to facilitate the use of Single Window environment. At EU level, Member States have committed themselves to action within the framework of e-Europe and, in particular, e-Government. Member States are expected to be able to accept electronic reports and their transmission via a Single Window latest in June 2015.
The Swedish system is known as ‘The Virtual Customs Office’ (VCO) and allows the submission, by electronic means, of customs declarations and of applications for import and export licenses, for licenses for strategic products and for both the import and export licenses. The system currently involves the Swedish Customs (lead agency), the Swedish Board of Agriculture, the National Board of Trade, the National Inspectorate of Strategic Products, the Police, the National Tax Administration and Statistics Sweden.

The Finnish system is called PortNet and is a national maritime traffic database. The user can give notices and get the information related for example to ship database, port arrival

notice, port departure notice, terminal notice regarding containers, issuing a single common customs reference number for the ship call, pay fairway dues.
E-administrative ICT can reduce the waiting times in the intermodal interfaces (harbours) and can lead to more intermodal and cost efficiency.

Table 15 Main application areas for smart ICT systems at Nureyev corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	DUT	Nureyev	Baltic Sea shipping routes: -Danish Straits -Kaddet Trench -Route North of Bornholm -Route South of Bornholm/ East of Ruegen	sea		Automatic Identification System (AIS) and Enhanced navigation support information (ENSI)	identifying and locating vessels (position, course, speed)	standardized VHF transceiver, positioning system such as a LORAN-C or GPS receiver, ship's navigational sensors	High utilization, difficult navigability due to the high utilization rate of many Baltic Sea shipping routes in accordance with difficult navigability and the transport of hazardous goods, accidents occur more often in the Baltic Sea than in other shipping areas.	Collision avoidance, managing ship traffic, aids to navigation, Accident Investigation
2	DUT	Nureyev	Baltic Sea areas: -Gulf of Bothnia -Gulf of Finland -Gulf of Riga - others	sea		IBNet (Icebreaker Net)		Possibly: Use of already existing (communication) -technologies	Ice causes several problems for the Baltic maritime traffic such as Speed reduction almost by half (in comparison to the average speed) Higher fuel consumption due to reduced speed, heating, etc.)	Reduction of waiting times, increase of throughput, less fuel consumption

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
									Restrictions for carriers with insufficient engine power or inappropriate qualification for navigation in iced waters Necessity for ships to be escorted/assisted by icebreakers	
3	DUT	Nureyev	Baltic Sea harbors			E-administrative (FRETIS, Single Window)	Cargo documents, tracking and tracing, landside container movements, information regarding the loading and unloading of vessels or trains, invoicing, etc.	Use of already existing (communication) -technologies	Extension of capacity and fastening the process in ports.	Increase of throughput, decrease in waiting times and enhancing competitiveness.
4	NTUA	Nureyev	Entire corridor	all		Anonymised sensor data gateway	Collect consumption emissions data	Relative sensors data gateway	Obtain information about emissions per individual vehicles	Environmental and economic attributes

Note: The ICT systems at harbors of the Baltic Sea were not examined, the specific applicability or transferability therefore might be difficult.

11. Cloverleaf corridor

The Cloverleaf corridor is passing through mainly the British part of the UK and through to Channel Tunnel to France via Calais and directly to Duisburg in Germany.

The corridor segment in Europe mainland includes passing through Belgium and the Netherlands. The Britain and Ireland segments include:

- Glasgow – Carlisle – Liverpool – London – Dover
- Liverpool – Dublin

The corridor between Glasgow and Dover is mainly served by road and rail based which also continue to connect to Continent Europe through Channel Tunnel and directly to Duisburg in Germany. Although Channel Tunnel has the capacity for 10 million ton per annum it served only just over 1 million tonnes per annum of freight through rail services out of the 19 million tonnes.

Short sea shipping is the only available connection between Liverpool and Dublin segment. It is a fact that the freight modal split of the Cloverleaf corridor is mainly dominated by road but UK Department of Transport (DfT) (2010) constructed a freight modal choice study which indicates that there are freight flows with potential for modal shift. IFW also indicate this is as a starting point of shift towards direct ferry services to the mainland Europe.

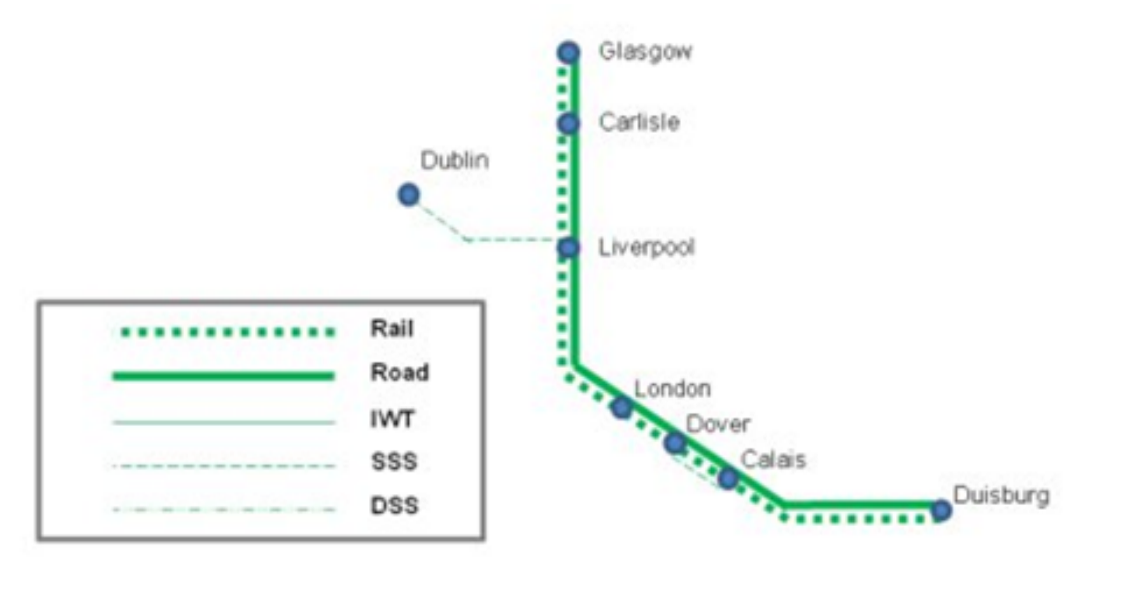

Figure 9 The Cloverleaf Corridor

11.1 Application Areas for smart ICT

The following information was taken from D2.5:

“Rail carriers are reported to have improved communication on consignment tracking, so this may be useful approach for ICT – through a GPS system – to play a role. This can also be applied to timetabling that generally avoids congestion and delay with the real time information service.

The interview data from Task 2.4 shows that some of the respondents are not using ICT to help their freight operations. The road freight operators reported full use of ICT of tracking/navigation system and this was reported helpful to help the trailer driver to anticipate bottlenecks. For rail operators, respondent reported use of ICT in its operation that is a terminal operation processing system and a loading level software between Glasgow and Midlands. This initiative can be introduced to other rail freight operators that do not use the system.

Reported congested area from Task 2.4 at around London M25, Kennedy Tunnel at Antwerp and other major ring roads including the one in Venlo, the Netherlands (one of the biggest centre for logistics in Europe) would benefit from the introduction of traffic signalling/control.

In anticipating road congestion, traffic signalling/control through urban traffic control (UTC) is commonly used in many UK cities and keeps growing in use by number. The system permits vehicle detection to be deployed at a much higher density than has previously been possible. Traffic signalling/control on average reduces delays by approximately 20% over typical fixed time system and reduces the journey time of up to 8% across the whole road network. This system also has a fuel saving potential of up to 20% .

UK HGVs represent 24% and vans 12% of the total domestic greenhouse gases and therefore are reviewed of its potential for improvement to meet low carbon technologies. A recent study funded by UK Department for Transport (DfT) review HGV technology low carbon application that are grouped into three different themes: vehicle, powertrain and fuel. The study shows that aerodynamic trailers, electric bodies and vehicle platooning have the greatest CO2 reduction potential of the HGV vehicle type. Additionally electric drives, fuel cells and full hybrids are important components that support greener powertrain technologies type. Moreover, biogas, biofuels and hydrogen are the greatest lifecycle CO2 benefit of the fuel technologies.”

As stated in D4.4v2 Platooning is designed to improve a number of things: Firstly road safety, since it minimises the human factor that is the cause of at least 80 percent of the road accidents. Secondly, it saves fuel consumption and thus CO_2 emissions with up to 20 percent. It is also convenient for the driver because it frees up time for other matters than driving. And since the vehicles will travel in highway speed with only a few meters gap, platooning may also relieve traffic congestion. The Platooning technology development is well underway and can most likely go into production within few years. The system will have positive effect on emission reduction. It has been estimated that platooning can reduce emissions up to 20 %.

Adaptive cruise control (ACC) can be used in the Cloverleaf corridor in order to adjust the driving speed of a vehicle to the current traffic situation according to ISO 15622 (Transport information and control systems – Adaptive Cruise Control systems – Performance requirements and test procedures) and ISO 22179 (Intelligent transport systems – Full speed range adaptive cruise control (FSRA) systems – Performance requirements and test procedures). It is estimated that EU implementation of Adaptive Cruise Control (ACC) systems can save 679 lives in 2020, when all vehicles have installed the required equipment. The system is in use and still under continuous development by automotive industry. The installed ACC system detects other vehicles driving ahead of the considered vehicle and calculates their driving speed. By braking or other speed reducing measures (e.g. engine/exhaust braking) a pre-defined clearance distance will be maintained. This ICT system is based on cruise control systems. Core of an ACC is the sensor control unit (SCU) which contains the radar, the ACC control unit and in some cases cameras.

Table 16 Main application areas for smart ICT systems at Cloverleaf corridor

No.	Partner	Corridor	Segment or transport chain	Transport Modes		Specific ICT technology	Data / Information	Installation Requirements (technology, software, data)	Bottleneck / Motivation	Related KPIs or Attributes
				Major Mode	Other Direct Beneficiary Users					
1	SCH	Clover Leaf	Friedewald on the highway axis, Euro channel, London city Ring	road		(Adaptive cruise control)	Speed, traffic data	Adaptive system components and compatible ICTs	Speed/driving behaviour supervision All systems which AUTOMATICALLY control truck speed are NOT recommendable as the truck drivers need to be flexible enough to accelerate speed if necessary to avoid a dangerous situation. Manual adaptation is recommended along all road legs in the corridors.	
2	SCH	Clover Leaf	vulnerable" legs within the corridors	road		Traffic control systems (TMC pro/TMC Plus,	weather data, congestion information, dangerous situations, speed control	shall be promoted in their latest technical version		

						GPS/GSM)	information systems attached to road infrastructure and mobile radio systems/location based systems			
3	NTUA	Cloverlea f	Entire corridor	all		anonymised sensor data gateway	Collect consumption emissions data	Relative sensors sensor data gateway	Obtain information about emissions per individual vehicles	Environment al and economic attributes

12. Selection of application areas for smart ICTs

The following table presents a summary of information of clusters of ICT systems per each of the 9 corridors and for all examined modes, on the basis of what is included in the previous sections.

Table 17 Summary of ICT clusters collected per corridor and per mode

	Corridor/Mode	Road	Rail	Maritime	Inland Waterways	SCM
1	Mare Nostrum			Centralised transportation management systems E-Administrative Systems, Broadcasting, monitoring & Communication systems, Emissions footprint calculator systems		Broadcasting, monitoring & Communication systems E-Administrative Systems Centralised transportation management systems
2	Brenner	Expert charging systems Broadcasting, monitoring & Communication systems Centralised transportation management systems Safety systems Decentralised transportation management system Emissions footprint calculator systems	Centralised transportation management systems Emissions footprint calculator systems	E-Administrative Systems Emissions footprint calculator systems		Broadcasting, monitoring & Communication systems

	Corridor/Mode	Road	Rail	Maritime	Inland Waterways	SCM
3	Two Seas	Decentralised transportation management system Safety systems Centralised transportation management systems, Broadcasting, monitoring & Communication systems Emissions footprint calculator systems	Centralised transportation management systems Broadcasting, monitoring & Communication systems Emissions footprint calculator systems	E-Administrative Systems Broadcasting, monitoring & Communication systems Emissions footprint calculator systems		Broadcasting, monitoring & Communication systems
4	Silk Way		Centralised transportation management systems Emissions footprint calculator systems	Broadcasting, monitoring & Communication systems E-Administrative Systems Centralised transportation management systems Emissions footprint calculator systems		E-Administrative Systems
5	Edelweiss	Decentralised transportation management system Centralised transportation management systems Expert charging systems Broadcasting, monitoring & Communication systems, Emissions footprint calculator systems	Broadcasting, monitoring & Communication systems Centralised transportation management systems Emissions footprint calculator systems			

	Corridor/Mode	Road	Rail	Maritime	Inland Waterways	SCM
6	Finis Terrae	Emissions footprint calculator systems, Broadcasting, monitoring & Communication systems	Emissions footprint calculator systems, Broadcasting, monitoring & Communication systems, Centralised transportation management systems,	E-Administrative Systems, Centralised transportation management systems, Emissions footprint calculator systems	Emissions footprint calculator systems, Broadcasting, monitoring & Communication systems	Emissions footprint calculator systems, Broadcasting, monitoring & Communication systems
7	Strauss				Centralised transportation management systems Emissions footprint calculator systems	
8	Nureyev			Broadcasting, monitoring & Communication systems Centralised transportation management systems E-Administrative Systems Emissions footprint calculator systems		
9	Cloverleaf	Decentralised transportation management system Centralised transportation management systems Emissions footprint calculator systems Safety systems				

The collected information in the previous sections is extensive. However, one can immediate observe its non-homogeneity. Still, one can use such information to obtain a selection of promising ICT application areas for possible implementation.

From this information, we need to make a selection of application areas, as more appropriate cases for future implementation beyond the scope of SuperGreen. The selection should take into account the following crucial issues:

- Expected improvement of KPIs after the implementation. This is perhaps the most important issue in selecting the final ICTs per corridor. The analysis of proposing the list of candidate ICT systems has revealed many problematic areas with strong or light motivation for a greener solution.
- Feasibility of implementation. According to the special requirements of each ICT, there are many important obstacles in implementing specific ICTs in some corridors due to lack of sufficient technical or operational background.
- Covering as many as possible different ICT solutions. Although many corridors would exhibit many environmental benefits from the same ICTs one must investigate as many as possible different ICT solutions in the various corridors.
- Availability and quality of information. It would be impossible to make an evaluation or a comparison in the face of elusive or incomplete information.

To that effect, Table 18 presents the proposed ICT applications to be further analysed in each of the selected corridors. The last column of the table represents the updated list of the candidate ICTs after deliverables D4.1v2 and v3. This update is presented only for completeness purposes but related input could not be further assessed for benchmarking since the second version of this report ran in parallel with deliverable D4.4v2 (see also Fig. 1).

Table 18 Selected ICTs per mode and per corridor

	Corridor	Transportation Modes	ICT Cluster (Application)	Updated list of ICT in cluster
1	Mare Nostrum	SCM	Broadcasting, monitoring & communication systems (SMARTBOX)	Veriwise
2	Brenner	Road Rail	Expert charging systems (congestion charging) Centralised transportation management systems (ERTMS)	 TAF TSI
3	Two Seas	Maritime	Broadcasting, monitoring & Communication systems (Broadband communication: WiFi/WiMAX, digital VHF, GNSS: GPS, Glonass, Galileo)	

	Corridor	Transportation Modes	ICT Cluster (Application)	Updated list of ICT in cluster
4	Silk Way	Maritime Rail	Emissions footprint calculator systems Centralised transportation management systems (ERTMS)	EREX
5	Edelweiss	Road	Emissions footprint calculator systems (Speed limits on the highway depending on CO2 emission values)	Skymeter
6	Finis Terrae	Maritime Rail	E-Administrative Systems (JUP) Centralised transportation management systems (ERTMS)	EREX
7	Strauss	Inland waterways	Centralised transportation management systems (RIS) Expert charging systems (river tolls)	
8	Nureyev	Maritime	E-Administrative Systems Centralised transportation management systems (assign icebreakers to ships)	Single Window Application
9	Cloverleaf	Road	Decentralised transportation management systems (platooning) Safety systems (adaptive speed control)	

The above ICT applications are the outcome of the work carried out in WP4. The Task4.1 produced a new list of ICT that could produce a green surplus. Task 4.4 was an in-depth analysis of various dominant scenarios of implementing critical ICTs in the 9 Corridors.

Due to the parallel execution of D4.1v3, D4.2v2 and D4.4v3, these additional technologies could not be fully assessed through the entire D4.4 benchmarking process. However, an attempt was made to incorporate those that could provide some different solutions in terms of functionality and performance.

From the above D4.1v3 updated ICT list, the Skymeter ICT and the TIS train Information ICT could have a potential implementation on the selected scenarios. More specifically:

- Skymeter could act either as an expert charging system on Road transportation in scenario 2 in the Brenner Corridor and
- As an emissions calculator on road transport in scenario 7 in Edelweiss Corridor.
- TIS could be an alternative train Information ICT system in scenarios 3, 6 and 9 in Brenner, Silk Way and Finis Terrae corridors respectively

Details on the rationale for choosing these ICTs are provided in D4.4v3 (see section 1.3).

13. Conclusions

This deliverable has an updated list of ICT according to Task 4.1 that could help towards greener transportation. It also contains a concrete analysis of the application areas based on the findings of Task 4.4. In this last version of D4.2, we have collected corridor specific information on the ICTs deployed and made a selection of a set of ICT applications. The proposed list of smart ICT application areas per corridor are as per Table 18.

From the analysis that took place in Tasks 4.2, 4,1 & 4.4 there are some critical conclusions towards greener transportation. First of all current technology provides a complete portfolio for all transportation problems in order to make processes more smooth and efficient. It is obvious that the emissions are expected to be lower in an efficient transportation system. For example modern ICTs can deal with complexity and increase infrastructure actual capacity or minimise delays and dead time. In all corridors the benchmarking is the key to reveal the best practices and transfer practical solutions in all areas with obstacles and suboptimal operation. The analysis shows that all corridors have problematic areas and numerous ICT applications could be implemented to provide sustainable solutions.

One could say that by implementing ICTs in various corridors and segments functionality will be increased and environmental impact will be reduced. The truth is that the benefits will be increased if the utilised ICTs are:

- Capable of integration. Integration is a multiplier in ICTs functionality and performance.
- Implementing expert system and decision support abilities. Expert systems can process raw information and add value to the operator of the ICT system.
- Real time operation and dynamic features. Adaptive systems perform better compared to static information systems.

The level of ICT utilization is different among EU countries. That means also a different level of ICT utilization along the corridors due to the multination dimension of them. For example terminals in various countries implement ICTs of different age, features and performance. EU should focus in the harmonization of these ICTs in the member countries.

Another critical point is that EU should start to consider all corridors with a holistic (logistics) approach aiming to define common EU trans European transportation standards. For example a common EU road charging system could:

- Eliminate the need for individual equipment.
- Minimise development, operation and service cost.
- Minimise bureaucracy.

The majority of ERTMS and EREX systems, added value does not occur from their technological aspects and functionality but from the holistic approach facing Trans European implementation. In the past years, 20 different systems, each in every different country was used for the same operation. ERTMS and EREX have multiplied functionality due to the presence of common European rail space. It is time for the other modes of transport to obtain their European common transport areas.

The modernization and Pan European integration of the IT infrastructure supporting ICT flows in port terminals is a top priority; this particularly applies to secondary European ports of South Europe, which have lagged behind in IT, and the improvement potential through business process reengineering is very high in these cases. Several terminals seek for port community systems. One could count several systems in the market providing similar solutions. It is not sure if these systems are and to what extend integrated between them. It is therefore a waste of resources to have so many products to solve the same problem and on the other hand to drop the benefits of a trans-European single window application. Integration is a multiplier on ICT functionality. This application could provide fully integration abilities and the ability of a centralised management of ports and transportation routes.

The analysis carried out in Task 4.2 version 2, is an analysis focusing in the specific problems of the corridors. It has truly produced promising results and revealed many application areas for greener transportation. A disadvantage of this analysis is that it is proposing local solutions aiming to solve local suboptimal areas. A holistic approach in the context of EU common transportation area is necessary in order to provide wide-ranging solutions and EU overall optimal operation of transport networks. This is already taken into account in WP 5 and WP6. The common EU transport areas are a necessity and EU is moving towards single window applications systems and centralised ITS. (EU Directives 2010/40 on ITS and 2010/65 on Single Windows).

Additional conclusions can be found in deliverable D4.4v3 and in the ICT-related sections of WP5 and WP6.

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