North Sea Freight
Intelligent Transport Solutions
NS FRITS

WP 3.6
To Study And Analyse How Data Capture/ Transmission Can Encourage Innovation And Increased Use Of Information And Communication Technologies Within The North Sea Region

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20 July 2011

VTEC Project No. 104-02851-12
VTEC Doc No. 06120-11-14320-1

The Interreg IVB North Sea Region Programme
Investing in the future by working together for a sustainable and competitive region

EXECUTIVE SUMMARY

The study investigates how the use of data collection, integration and distribution can encourage innovation and the increased use of information and communication technologies (ICT) in the road freight transport (RFT) sector within the North Sea Region (NSR). The study builds on work undertaken in other work packages within NS FRITS. The results of this study are focussed on the RFT sector and the NSR, however, lessons learned from other projects are taken from a wider geographical area and technical scope.

Long distance freight transport in the NSR is heavily influenced by the geography of the region, and in particular by the many sea crossings that are necessary throughout the region and the numerous border crossings. Cross-border road freight traffic between the seven countries of the NSR involves:

- Significant traffic flows originating or terminating outside the NSR and transit traffic through the NSR,
- Multiple languages, laws, and cultures,,
- Multiple security and emergency services with different contact numbers,
- Border crossings within the EU single market, between Schengen and non-Schengen countries, to non-EU or non-EFTA countries, and the proximity to Eastern Europe, with different passport inspection, customs regulations and inspections requirements.

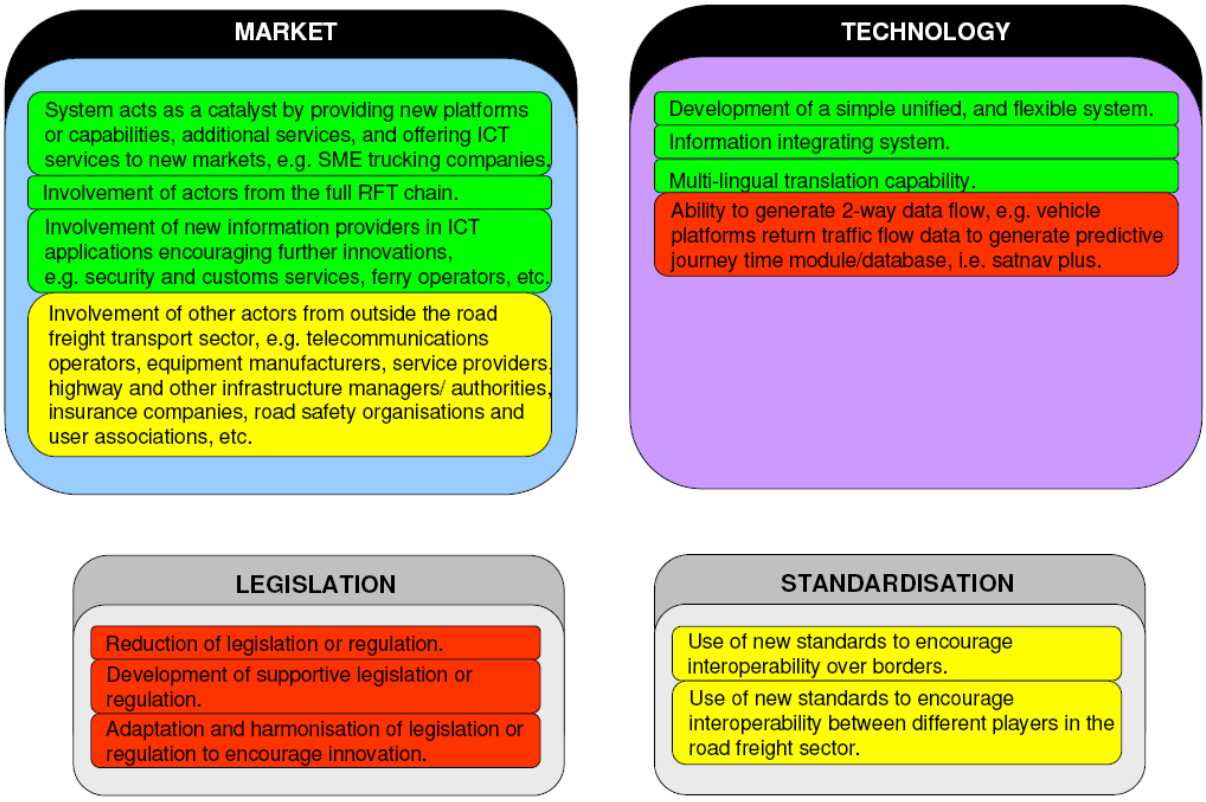
Innovation is the successful exploitation of new ideas. An innovation is more than an invention, but may use an invention as its basis. Invention is the development of a new idea, while innovation is the commercial application and successful exploitation of an idea. In dynamic markets, constant innovation is necessary to remain competitive with the pace of change imposed by new technologies, market conditions and changing customer profiles. Successful innovations require consideration of three key elements; users, technology and strategy including financing. There are different approaches to innovation which can be categorised as market driven and technology driven. Innovation is influenced by four main groups of actors; infrastructure providers, service providers, end users and regulators. There have been numerous examples of technological based innovations in ICT spurring product or service innovations, e.g. the development of mobile phones and the internet. In both cases the products or services that have been developed from the platform provided by the basic technology would have been impossible without that technology. When potential demand for a new service is identified, there may be barriers to the introduction of such a service necessitating technological, service or process innovations, and in turn those innovations also encourage new demands and innovations. The innovations needed could be new platforms, new capabilities such as being multi-lingual, new processes permitting, for example, cross border SIM cards, or new services.

In order to understand how the use of data collection, integration and distribution can encourage innovation and the increased use of ICT in the RFT sector within the NSR, the report considers the issues from a range of different perspectives. It identifies the factors that inhibit the use of ICT technology, and the features that users require from ICT in the RFT sector, as well as reviewing the lessons learned from earlier activities within NS FRITS and from similar projects and commercial activities.

Some larger transport companies and service providers in the RFT sector, such as ports, already use limited ICT systems for specific tasks, and advanced ICT solutions for the RFT sector are being developed in a number of collaborative European projects. However, the systems are very fragmented and only provide solutions to individual or a limited number of the services that RFT operators need. This fragmentation of ICT solutions inhibits wider ICT take up due to the increased costs associated with the fragmented systems and the infrastructure required to operate them. In addition fragmented systems can increase driver workload with road safety implications. In contrast, NS FRITS is an integrated concept

bringing together data collection, integration and distribution which are merged into a single ICT solution.

NS FRITS encourages innovation in the RFT sector by offering a trans-national solution that collects, integrates and distributes data from a wide range of sources, including a two way communication capability. Using these features as the basis, it is probable that with adequate development the NS FRITS system could be the platform for many service innovations in the RFT sector and beyond. The figure below shows the main mechanisms for encouraging innovation in the use of ICT by the RFT sector.



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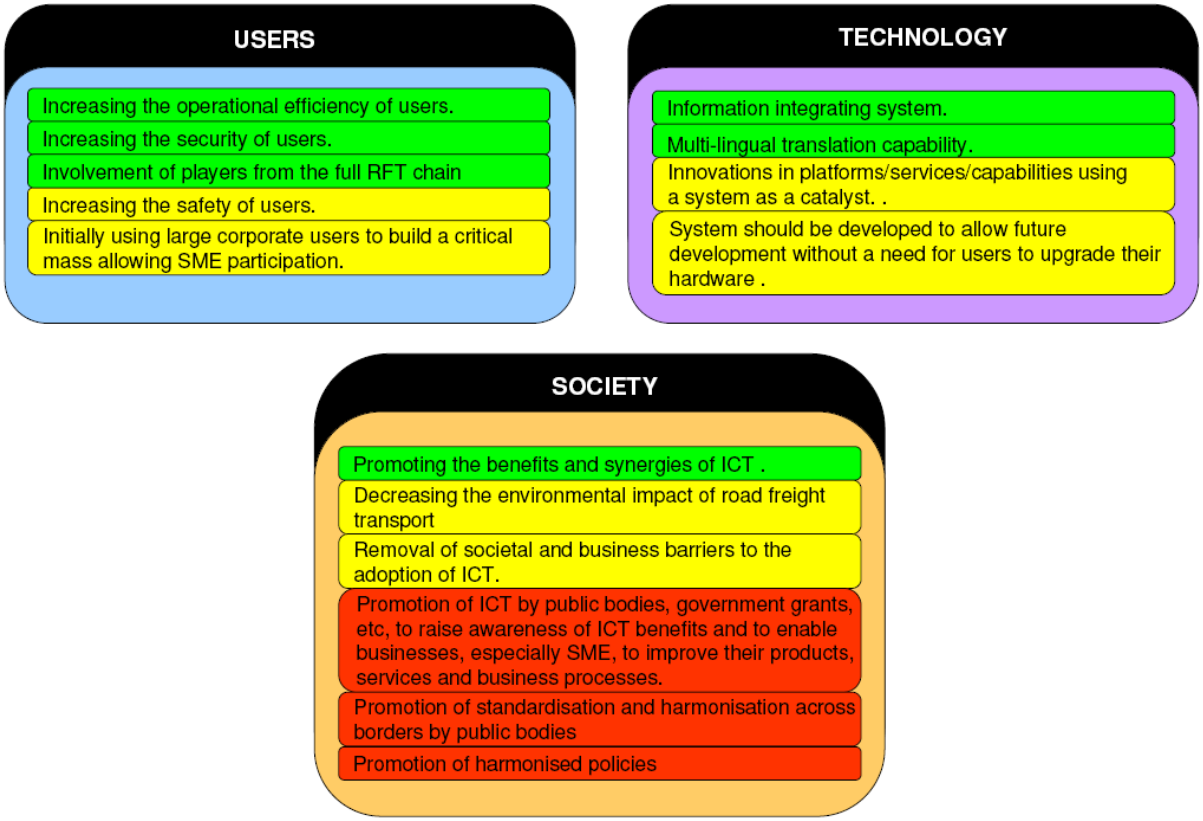
Mechanisms For Encouraging Innovation In The Use Of ICT By The RFT Sector

Many issues need to be adequately addressed to encourage the increased use of ICT in the RFT sector, and among the most prominent of these are the need for user acceptance, secure services, and the promotion of ICT services to the RFT sector and in particular to SME operators. The need for services dealing with security issues has, however, to be balanced against recognition that the technology can be used in an intrusive manner which may be of particular concern to drivers and the SME sector. The challenge is to achieve a balance such that the intrusive aspects of the system do not become unacceptably so, and in particular to understand what is acceptable which vary from operator to operator.

To encourage increased usage of ICT the NS FRITS system needs to develop user acceptance by providing multiple, value added services that are enabled by the system, and to allow data providers to plug-in easily to the system. Data sources need to be vetted to ensure that they provide accurate and current data. The system also needs to be robust and stable to ensure 24/7 availability. It also needs to be developed so that it can respond to needs as they evolve, and to allow future development without a need for users to upgrade their hardware. Increased use of ICT through data collection, integration and distribution can be encouraged by the mechanisms shown in the figure below.



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Mechanisms For Encouraging Increased Use Of ICT Through Data Collection, Integration And Distribution

A key question to be addressed is how innovation and the increased use of ICT in the RFT sector can be stimulated after the lifetime of the NS FRITS project. One project that has been identified was the BESTUFS II project. BESTUFS II is a follow-up initiative of the successful BESTUFS project to identify, describe and disseminate best practices, success criteria and bottlenecks with respect to City Logistics Solutions (CLS) The project aims to maintain and expand an open European network between urban freight transport experts, user groups/associations, ongoing projects, the relevant European Commission Directorates and representatives of national, regional and local transport administrations, and transport operators. The results of NS FRITS could be presented to the network, and it could be used to explore how the use of ICT in the RFT sector can be further encouraged.

CONTENTS

1 INTRODUCTION

The study investigates how the use of data collection, integration and distribution can encourage innovation and the increased use of information and communication technologies (ICT) in the road freight transport (RFT) sector within the North Sea Region (NSR). The study builds on work undertaken in other work packages within NS FRITS. The results of this study are focussed on the RFT sector and the NSR, however, lessons learned from other projects are taken from a wider geographical area and technical scope.

2 NORTH SEA REGION

The NSR refers to European countries and regions bordering the North Sea. Although not a formally established entity, the NSR is consolidated through trans-national cooperation programmes such as the North Sea Region Programme of the European Union. The NSR covers an area of 664,000 km^2, and includes the whole of Norway and Denmark, the eastern parts of the UK, parts of the Flemish Region of Belgium, the north western regions of Germany, the northern and western parts of the Netherlands, and the south western region of Sweden [1], see Figure 1. Approximately 60 million people live in the NSR, however, the population density of the region varies widely, ranging from sparsely populated northern Norway to the densely populated areas of the Netherlands. Economically the NSR includes many relatively prosperous regions of the EU, however, there are notable differences concerning economic performance and employment between the areas in the NSR. Many areas within the NSR are undergoing considerable changes, with the decline of the fisheries sector and many old industrialised areas.

Source: [2]
Figure 1: North Sea Region

Long distance freight transport in the NSR is heavily influenced by the geography of the region, and in particular by the many sea crossings that are necessary throughout the region and the numerous border crossings. Cross-border road freight traffic between the seven countries of the NSR involves:

- Significant traffic flows originating or terminating outside the NSR,
- Significant transit traffic through the NSR,
- Multiple languages,
- Multiple laws,
- Multiple security and emergency services and contacts,
- Multiple passport inspections,
- Multiple customs regulations and inspections,
- Border crossings within the EU single market,

- Border crossings between Schengen and non-Schengen countries,
- Border crossings to non-EU or non-EFTA countries,
- The proximity to Eastern Europe.

3 INNOVATION

3.1 What Is Innovation?

"*the action or process of innovating*"	" *the introduction of something new*"
"*a new method, idea, product, etc.*"	" a *new idea, method, or device : novelty*"
Oxford English Dictionary	Merriam-Webster Dictionary

Innovation is the successful exploitation of new ideas [3]. An innovation is more than an invention, but may use an invention as its basis. Invention is the development of a new idea, while innovation is the commercial application and successful exploitation of an idea [4]. If an invention leads to a new or improved product, process or service offered by an organisation, then that invention transforms into an innovation. An innovation can be considered as the extension of an invention. Innovation involves taking the work of an individual or team of inventors to a broader audience. An innovation can be a single major breakthrough, e.g. a totally new product or service, or a series of small, incremental changes, and have a large or small effect. The type and style of innovation, and the industry or business sector in which it is applied are irrelevant; the key is an innovation's impact.

Innovation is the process of introducing something new into a business and may be either a process innovation or a product innovation, more specifically [4]:

- Developing entirely new or improved products,
- Adding value to existing products, services or markets to differentiate the business from its competitors and increasing the perceived value to the customers and markets,
- Improving or replacing business processes to increase efficiency and productivity, or to enable the business to extend the range or quality of existing products or services.

3.2 Why Innovation Is Important?

The future of many businesses depends upon their ability to innovate, especially in competitive markets. In dynamic markets, constant innovation is necessary to remain competitive with the pace of change imposed by new technologies, market conditions and changing customer profiles. Innovation improves wealth creation by a company, and although efficiency is essential for the success of a business it is not able to sustain business growth without being complemented by innovation.

3.3 Realising Innovations

Innovation is often viewed as a technical activity, however, success is measured by acceptance in the market [4]. Successful innovations require consideration of three key elements as shown in Figure 2; users, technology and strategy. In order to innovate successfully the needs of the users and the dynamics of the market must be understood. The technology on which the innovation is based must be feasible within the appropriate price range. A strategy is needed to align the technology with the needs of the users to successfully bring the innovation to the market.

There are different approaches to innovation which can be categorised as market driven and technology driven [4], as shown in Figure 3. The market can demand incremental changes through ongoing development, e.g. adding an alarm clock to a mobile phone, however, the

initial development of the mobile phone infrastructure and concept is more likely to be driven by technological breakthroughs. Market driven approaches include market feedback driving incremental improvements through ongoing development, using new design or customisation to add value, and new business models such as embedding a product inside a service. Technology driven innovation includes the exploitation of new technologies, allowing increased functionality, and fusing different technologies to add value.

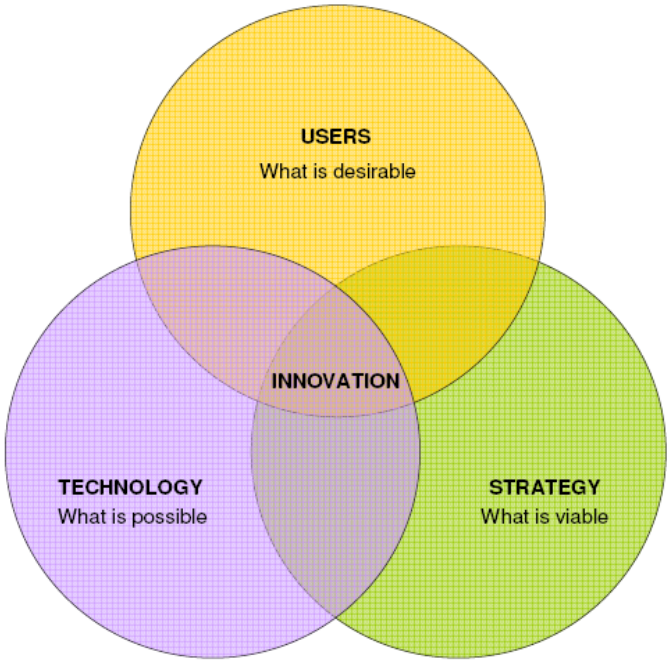


Figure 2: Elements of Innovation

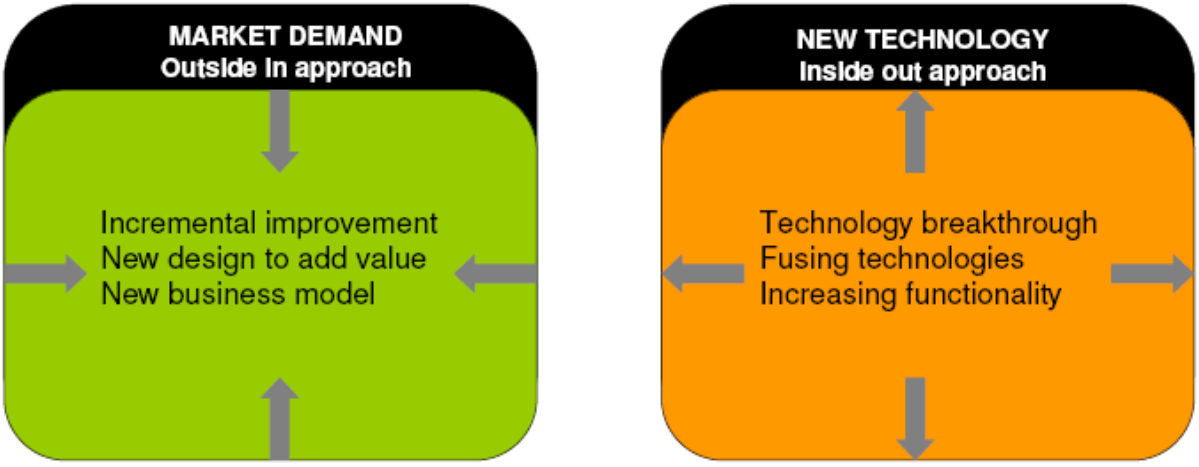
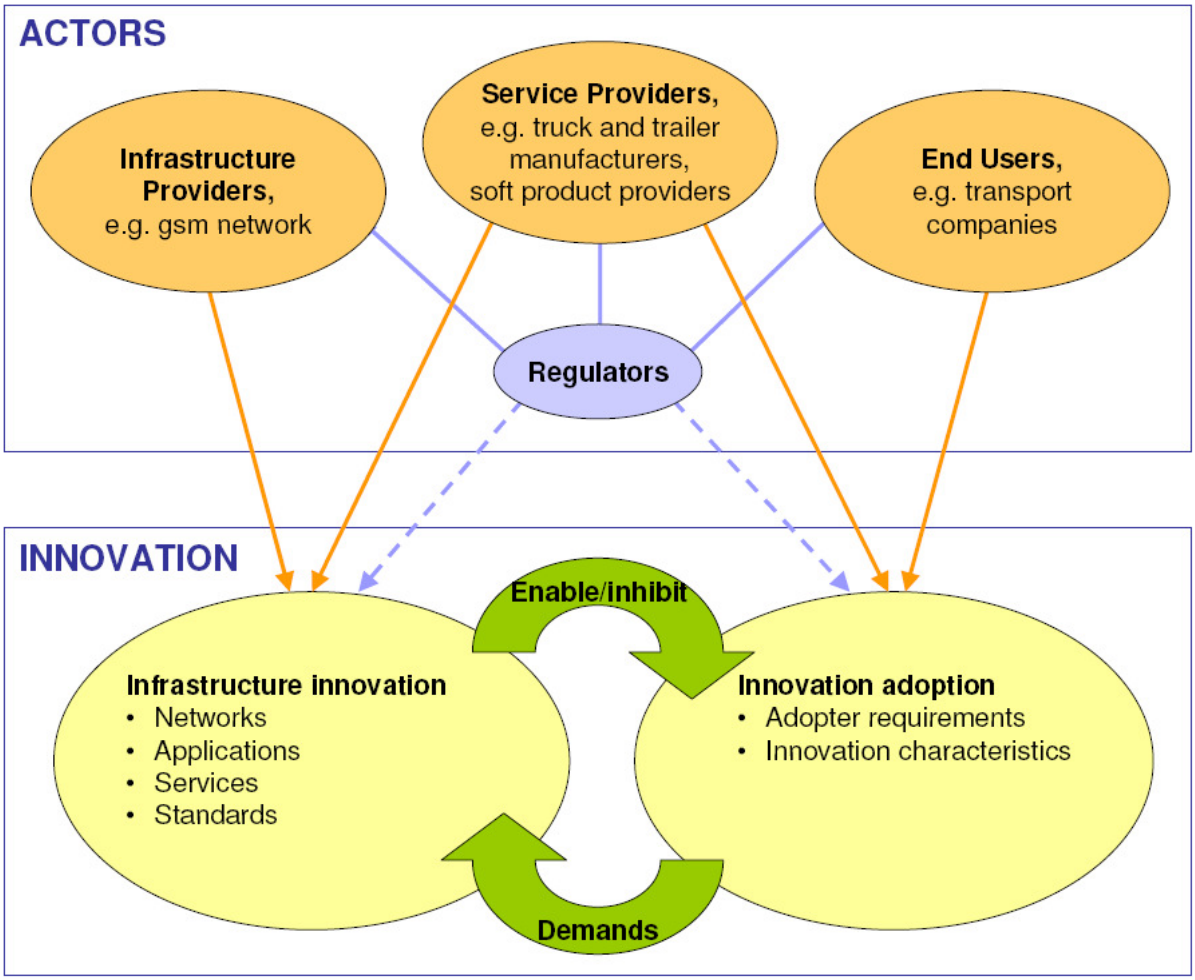


Figure 3: Approaches to Innovation

4 ICT AND INNOVATION

In recent decades the introduction of ICT to many areas of life has led to innovations in terms of hard and soft products or services that are now taken for granted, but that only two decades ago would have been in the realms of science fiction. An innovation framework for ICT with related actors is shown in Figure 4. Innovation is influenced by four main groups of actors; infrastructure providers, service providers, end users and regulators. Providers influence the innovation infrastructure, while users influence the adoption and uptake of innovative technologies. Regulators can influence users and providers as well as the

innovation infrastructure, and can either encourage or inhibit innovation. Infrastructure innovation includes aspects such as developing and maintaining reliable networks, the development of applications, and the provision of services through the infrastructure. These factors can either enable or inhibit innovation adoption by users depending on whether they fulfil user requirements and whether they have the correct characteristics. In turn, the demands of innovation adoption influence the development of the innovation infrastructure.



After [5]

Figure 4: Influence of Innovation Actors On The Innovation Framework For ICT

5 ENCOURAGING INNOVATION AND INCREASED USE OF ICT IN ROAD FREIGHT TRANSPORT

5.1 Introduction

There have been numerous examples of technological based innovations in ICT spurring product or service innovations, e.g. the development of mobile phones and the internet. In both cases the products or services that have been developed from the platform provided by the basic technology would have been impossible without that technology. Some of those products or services have in turn spurred other innovations, e.g. PayPal which has allowed many smaller internet businesses to become established. Figure 5 shows a generalised mechanism for this cascading innovation process. When potential demand for a new service is identified, there may be barriers to the introduction of such a service necessitating technological, service or process innovations, and in turn those innovations may also

encourage new demands and innovations. The innovations needed could be new platforms, new capabilities such as being multi-lingual, new processes permitting, for example, cross border SIM cards, or new services. It is likely that the NS FRITS system will spur the development of new services based around the capabilities and functionality of the NS FRITS system.

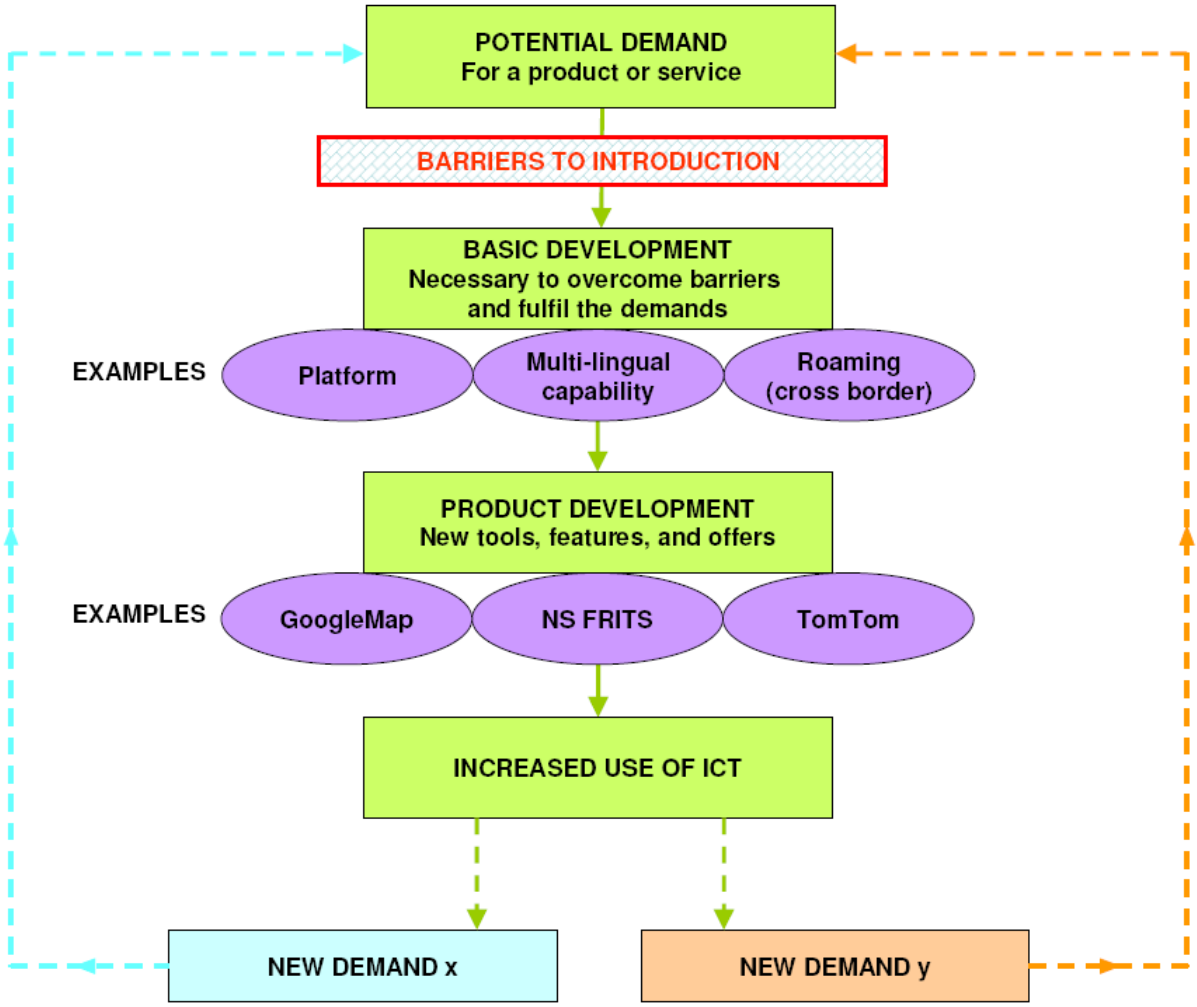


Figure 5: Cascading Innovation

In order to understand how the use of data collection, integration and distribution can encourage innovation and the increased use of ICT in the RFT sector within the NSR, this section considers the issues from a range of different perspectives. It identifies the factors that inhibit the use of ICT technology, and the features that users require from ICT in the RFT sector, as well as reviewing the lessons learned from earlier activities within NS FRITS and from similar projects and commercial activities.

5.2 What Do Users Require From ICT In The Road Freight Transport Sector?

A key aspect of providing any service is to understand the demands and requirements of actual and potential users of the system as they may be very different from what technology/service providers want to provide. With respect to ICT in the RFT sector the needs of different users/data providers have been identified in various NS FRITS surveys and workshops, e.g. Driver Survey [6], the Nordic Stakeholder Day in Gothenburg [7], and the System Demonstration/ Evaluation Seminars in Hull and Rotterdam [8]. The Driver

Survey, as the name implies focussed on the views of drivers, with approximately 80% from SME. Participants from large companies, SME and other organisations linked to the RFT sector were represented at the Gothenburg, Hull and Rotterdam events. Participants represented a variety of professions at those events, ranging from drivers to senior transport managers, regulators and the emergency services. The needs of the different users/data providers have been synthesised from the results of the NS FRITS activities, and have been grouped into economic, operational and technical aspects, see Figure 6.

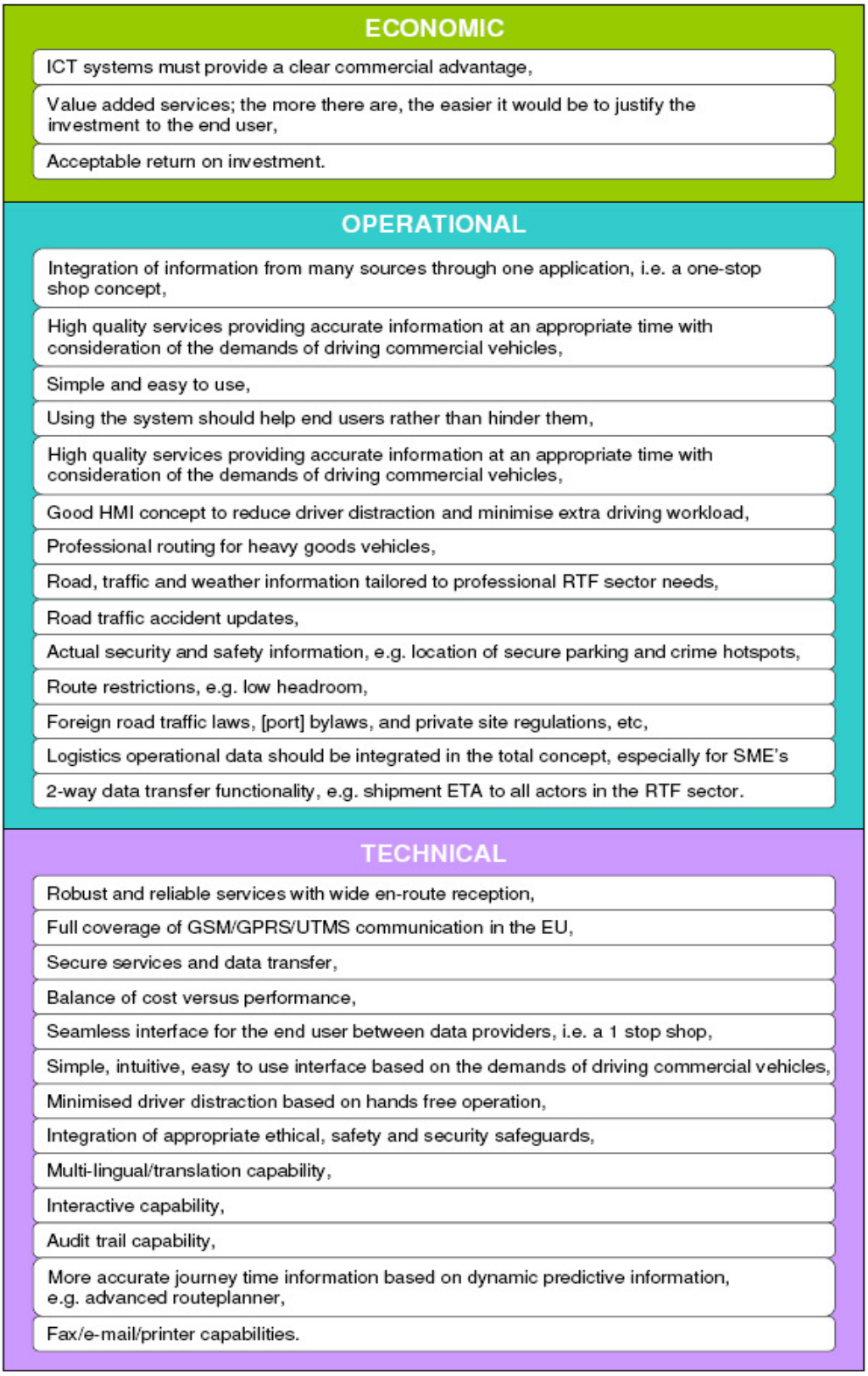


Figure 6: What Users Require From ICT In The Road Freight Transport Sector

5.3 What Inhibits The Use Of ICT In Road Freight Transport?

The uptake and use of ICT in the RFT sector can be inhibited from the perspective of the transport companies and the drivers. The companies must see the benefits to be gained by the provision of ICT, and even if ICT is provided its benefits are lost if the drivers do not use it, or use its full capabilities. The uptake and use of ICT in RFT can be inhibited by a variety of factors linked to economic, technical, economic and educational issues, see Figure 7.

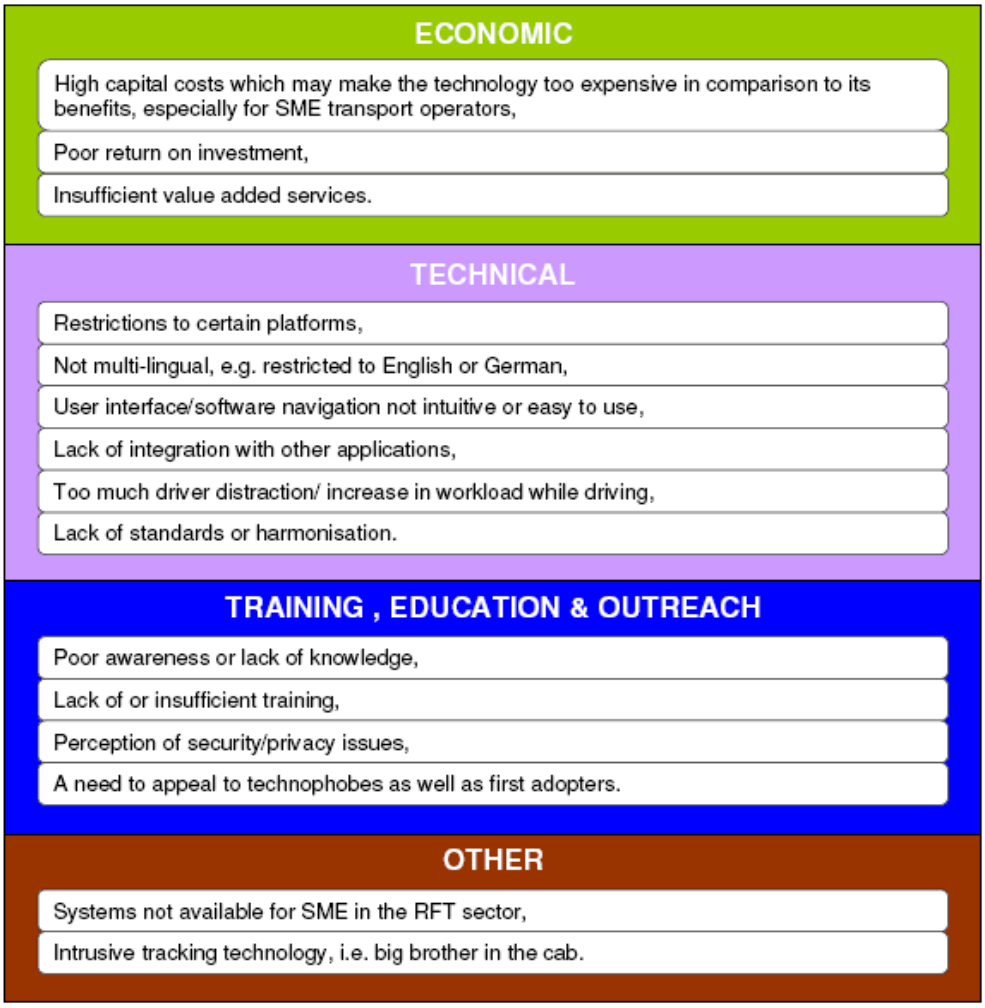


Figure 7: Factors Restricting The Use Of ICT In The Road Freight Transport Sector

5.4 Lessons Learned From Other Projects

5.4.1 Introduction

The use of ICT in the RFT sector has been acknowledged to be a key link in the drive to enhance efficiency, reduce congestion, and to improve accessibility to urban and port areas. In addition to NS FRITS there are many other ICT projects aimed at the RFT sector. Truck manufacturers such as Volvo and Renault are engaged in many research projects to investigate how to tailor the needs of ICT to commercial road transport, and already have commercial ICT systems in operation, e.g. Dynafleet. A number of EU co-funded projects in the 6th and 7th Framework Programmes focus on the use of ICT in the RTF sector. National activities have also been undertaken, such as the Swedish ARENA project. Many activities in Sweden are related to value added services in connection with road user charging systems.

As part of the work to produce the "NS FRITS Technical Concepts" document [9], many of these projects were researched to establish if they were relevant to NS FRITS. Following this work, the projects listed in Appendix 1 were identified as being most relevant to NS FRITS activities [10]. In addition to those projects, other projects were identified as having some relevance to NS FRITS and are listed in Appendix 2, which also lists a number of other European and national projects identified since the original research including a number of national Swedish projects.

The lessons learnt from of some of the most relevant projects with respect to the scope of this report are summarised in this section.

5.4.2 Smartfreight

The now complete SMARTFREIGHT project, funded through the EC 7th Framework Programme, aimed to make urban freight transport more efficient, environmentally friendly and safe by responding to challenges related to traffic management and freight distribution management. The main objective of SMARTFREIGHT was to specify, implement and evaluate ICT solutions that integrate urban traffic management systems with the management of freight and logistics in urban areas. The transport operations carried out by the freight distribution vehicles would be controlled and supported by means of a wireless communication infrastructure with on-board and on-cargo equipment.

Smartfreight has been tested by alternative methods at 4 European sites:

i) Test site in Trondheim, Norway, where SMARTFREIGHT will cooperate with the "Wireless Trondheim Network Lab", which is offering a city-wide physical high capacity communication network using the CALM standard. The SMARTFREIGHT test site in Trondheim will use the wireless infrastructure.
ii) Simulations in Winchester, UK to prove the SMARTFREIGHT concepts.
iii) Simulations in Bologna, Italy.
iv) Desktop Study in Dublin, Ireland.

The impact assessments performed at the test sites provide some insights into how the SMARTFREIGHT concepts and the related extended services would work, and allows an assessment to be made of the outcomes that could be expected if the system is fully implemented. The main objective of developing and implementing the SMARTFREIGHT concept was successful, and the technology was proven to work. The tests showed that only limited knowledge could be gained from the tests performed. It was also found that the general impacts of SMARTFREIGHT on urban transport are dependent on the state-of-the-art and the technological trends when applied in an urban context.

5.4.3 ARENA

ARENA is an ongoing Swedish R&D project supporting the national strategy for road charging in Sweden, including a test site to demonstrate practical solutions. The project also undertakes research in the field of e-transactions.

The ARENA project serves as platform for stakeholders within the area of road user charging. The goal is to gather knowledge and skills in science, industry and the public sector to understand the opportunities and constraints of road user charging in a complex, international and competitive telematics environment. ARENA is funded by the Swedish Transport Administration, VINNOVA and the European Regional Development Fund.

5.4.4 ICT For Cargo On The Road

The aim of ICT For Cargo On The Road is to study how public applications, such as a road user charging system for HGVs can be integrated with other applications for HGVs, and to develop prototype value added services. By combining the system for road user charging with applications providing value added services, several benefits are realised. For example, value added services can support increased user acceptance for the charging system, and the equipment and operational costs can be shared across several services thus making them more cost effective [11].

Trial value added services were identified through a series of interviews with public authorities, service providers, and drivers/carriers.

The public authorities requested a dangerous goods tracking service in order to minimise the impact on the society when an accident occurs, and to have better control of where dangerous goods are transported. The authorities also requested services for real time traffic information, and a predictive travel time service based on real time probe data.

Most service providers highlighted real time traffic information and predictive travel time information, both based on probe data, as the main services to focus on. Almost all of the service providers highlighted the need to improve basic data to develop several services.

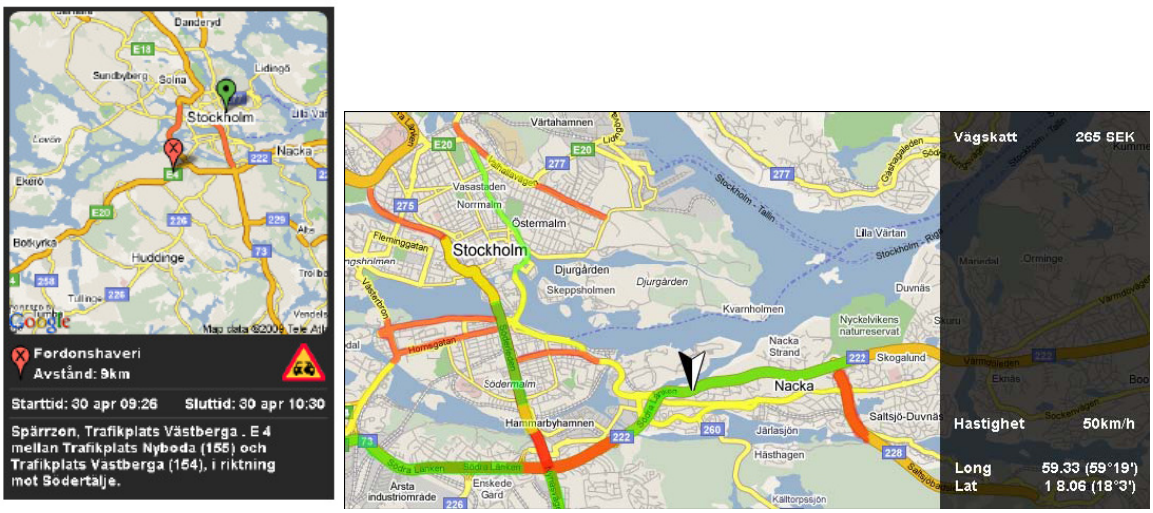
Drivers and carriers expressed a need for services focused on the operation of the business, and highlighted dynamic traffic information for HGVs, dynamic resource optimisation, and track and trace services. Dynamic resource optimisation was viewed as a combination of traffic information, track and trace, cargo information, pickups, deliveries, destinations, weights and volumes. Many service providers provide these services through separate systems but not in a combined solution as the transportation companies require. Drivers and carriers also asked for a service that is developed for the needs of the RFT sector as most of the services on the market today are developed for cars. Requested services include static and dynamic traffic information including information about temporary restrictions.

ICT For Cargo On The Road has developed three prototype services to be implemented together with a demo version of the related road user charging system:

- Dangerous goods service,
- Real-time traffic information service,
- Dynamic/static traffic information service.

The system was developed in two forms. First, a web based service to be easily accessible to new service providers and independent of the vehicle platform. The service was developed so that it is independent of the size of the vehicle display. One important outcome from the interviews was that the driver should have the possibility to receive information on different platforms, and not only platforms integrated in the vehicle. As a result a service was developed for the Android platform. The Android service receives the same information as the vehicle platform. Typical screen shots are shown in Figure 8.

The system also provides public authorities with internet based access to dangerous goods shipments, both statistical and real time, see Figure 9.



Source: [11]

Figure 8: Typical Screen Shots From The ICT For Cargo On The Road Prototypes

Source: [11]

Figure 9: Internet Service For Dangerous Good Shipments

5.4.5 East-West Transport Corridor

The East-West Transport Corridor project is now in its second phase, and through international cooperation aims to develop the efficient, safe and environmentally friendly handling of the increasing amount of goods being transported east-west in the southern Baltic region. The project will assist stakeholders in the region to enhance sustainable transport planning, and to develop smart IT solutions for goods transport. During the original project an expert workshop was held in Sweden to investigate the impacts and possibilities of applying road user charges to heavy goods vehicles [12]. The results of the seminar highlighted a number of important points that are equally applicable to NS FRITS.

In particular it is necessary to take into account impact at different levels of government and to try to avoid conflicting policies between public bodies.

An overall recommendation from the seminar was to make a system unified, simple and flexible. Value added services should be grouped into different categories using road user charging as the basis:

- Public added value – Authority driven applications to support policy goals,
- Commercial added value – Market driven applications.

A key challenge will be to find an organisational solution that enables value added services without endangering the implementation of the charging application. A further complication is who will pay for the extra capacity required for enabling value added services. In practice the main challenge will be to agree on which information should be available and to agree on the protocols. The recommendation for the demonstrations of the East-West project was to focus on a demonstration of a public added value service, and to enable commercial value added services as the market will be the driver for those services with their understanding of the market demands.

At the seminar, key lessons from the NorITS project were presented, a project that enables interoperability in the Nordic countries, including:

- Competing services and organisations should be taken into account,
- Border problems occur,
- Customer loyalty schemes and other market efforts may be harder to communicate,
- Client's willingness to participate,
- How to regulate payment for "piggybacking" on another service.

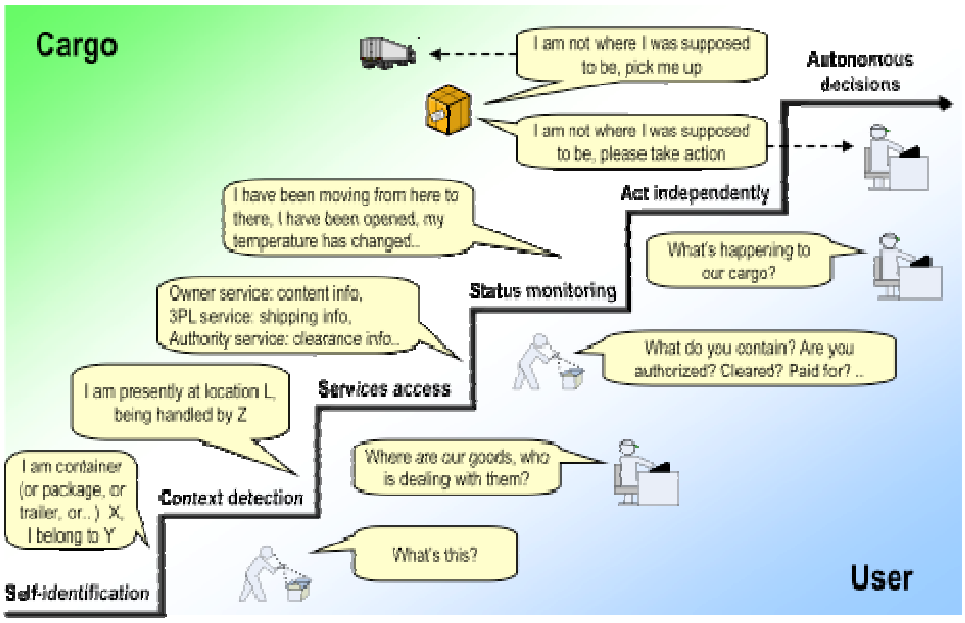
5.4.6 EURIDICE

EURIDICE is an Integrated Project funded by the EC 7th Framework Programme which started in 2008 and will run for 3 years until October 2011. The basic concept of Euridice is to build an information services platform centred on the individual cargo item, and on its interaction with the surrounding environment and the user.

The EURIDICE project has the following main objectives:

i) Supporting the interaction of individual cargo items with the surrounding environment and users in the field,
ii) Improving logistics performance through application of the intelligent cargo concept and related technologies into the working practices of operators and industrial users,
iii) Developing collaborative business models to sustain, promote and develop an intelligent cargo infrastructure,
iv) Realising more secure and environmentally friendly transport chains through the adoption of intelligent cargo to support modal shift and door-to-door inter-modal services.

The use of advanced technologies including smart tags, sensor networks and distributed intelligent agents, does not by itself define Intelligent Cargo. The EURIDICE definition of Intelligent Cargo is based on **capabilities**. Not all the Intelligent Cargo capabilities are required in every user scenario. Advanced capabilities support very sophisticated applications to address special user needs. Nevertheless, even basic capabilities, will bring important changes to the logistics users' daily practices once implemented, as shown in Figure 10.



Source: [13]

Figure 10: EURIDICE Intelligent Cargo Capabilities

Final results and conclusions will be available by November 2011 when the EURIDICE project will be completed.

5.4.7 e-Freight

e-Freight is a four year Integrated Project funded by the EC 7th Framework Programme, which started in 2010 bringing together 30 partners from 14 EU member states and Norway. The project addresses the development, validation and demonstration of innovative e-Freight capabilities. e-Freight capabilities will be developed to support the following four main categories of stakeholders:

i) Transport users (shippers, freight forwarders, etc.) to identify and use the direct or combined transport services most suited to their purposes.

ii) Transport service providers to provide information about their services and exchange information electronically with relevant actors through planning, execution and completion of transport operations. The setting up of (liner) service networks adhering to co-modality principles for improved efficiency and end-to-end quality of surface freight transportation.

iii) Transport infrastructure providers to facilitate the best possible use of the complete transport infrastructure, and to support transport users by providing information about the available transport infrastructure and how to use it.

iv) Transport regulators to obtain in the simplest possible way the required information for monitoring compliance with applicable regulations, and to exchange information with other authorities for collaboration in security and environmental risk management.

e-Freight related developments are expected to lead to “Intelligent Cargo” in the future, meaning that goods will become self-context and location-aware as well as connected to a wide range of information services, thus further automating the transportation management process. One of the aims of e-Freight is to enable transport users (shippers, freight forwarders, etc) to identify and use the direct or combined transport services most suited to their purposes, and for which open freight transport e-market places are necessary. This is dependent on transport service providers publishing their services on the internet in a manner that can readily be used by independent web based transport management systems. This requires stakeholder engagement in the promotion of more open networks and

innovative but practical utilisation of web service standards and enabling technologies. The e-Freight project will develop a suitable registry of e-Freight services and means for their secure interconnection, supporting an evolutionary approach to the development of e-Freight market places.

As e-Freight will run until 1 January 2014, no direct results that may be of interest for NS FRITS are available yet.

5.5 Related Commercial Applications

5.5.1 Introduction

The use of ICT in the RFT sector has already been acknowledged by industry to be a key factor in the drive to enhance efficiency and reduce congestion for road freight transport, and commercial ICT systems are already in operation, e.g. Dynafleet. Some commercial applications are summarised in the following sections.

5.5.2 Dynafleet

Volvo's Dynafleet is an online system operated by Volvo Trucks to support the improved profitability of truck operators. The system allows fleet managers to view in real time the current location of their vehicles, their fuel consumption, messages, driver times, service intervals, etc. By providing clear and accurate information, the system makes it easier for the truck operators to take the correct decisions. Dynafleet provides everyone in the transport chain important information increasing the understanding of the entire operation, and allowing costly mistakes to be avoided. The assignments are carried out more efficiently and planning is easier.

Dynafleet consists of four "cornerstones", see Figure 11, of which the operators can either choose one or combine several to suit their needs, which naturally differ depending on the type and size of operation. All four cornerstones can be integrated with the operator's existing administrative system.

Source: [14]

Figure 11: The Four "Cornerstones" Of The Volvo Dynafleet System

The four cornerstones of the Volvo Dynafleet system are:

Fuel & Environment
Dynafleet supports the quest for lower fuel consumption and reduced environmental impact. The system offers detailed reports that make it easy to chart potential improvements and to follow up the results. Many customers use Dynafleet as a tool for analysis in combination with driver training in fuel-efficient, eco-driving techniques.

Positioning
Positioning makes it easier to plan transport assignments and carry them out in the most efficient way possible. Detailed maps provide full control whatever the situation.

Driver times
Driver times provides an overview of how the drivers spend their working day, facilitating both transport planning and administration.

Messaging
Messaging functions in the same way as email and makes it possible to send simple, quick and cost-effective text messages between the office and the truck fleet.

Examples of the benefits of Dynafleet to the various participants in the transport operation are given below:

The driver
The driver receives rapid and accurate information in clear text. The driver's environment is safer and there are fewer misunderstandings. With Dynafleet, the driver can take decisions that promote more economical driving. Onboard navigation can be integrated with the system.

The traffic planner
The traffic planner can take decisions to maximise the utilisation of the entire vehicle fleet and minimise empty runs, allowing the company to handle more orders with the existing personnel and vehicle fleet. At the same time, there is less stress and the working environment improves.

The fleet manager
The fleet manager can plan service intervals to maximise utilisation of the vehicle fleet. The information stored in the system makes it easy to follow up either individual vehicles or the entire fleet. Dynafleet also gives the company an objective basis for the subsequent reward of those who do things correctly.

At the office
Administrative work is made easier. Dynafleet is easily integrated with existing office systems via a software option (API).

The transport buyer
Transport buyers no longer have to call the haulage contractor for delivery status information. Instead, they can access real-time information by logging onto Dynafleet Online. The Customer Online Tracking function provides details on when the goods were loaded, the current location of the goods and its estimated time of arrival.

Dynafleet is a web-based package that communicates with the mobile tracking hardware installed on the trucks, see Figure 12. GPS devices and associated hardware communicate detailed data to the Dynafleet main database, which can be accessed via internet from any PC.

Source: [15]

Figure 12: Volvo's Dynafleet In-cab Unit

A hardware unit is installed inside the vehicle together with a combined GPS/GSM antenna. A communication screen in the vehicle allows for two-way communication between the driver and the office. In addition to fuel consumption, the hardware is capable of logging how many times the vehicle stops, its load during each stage of its trip, its AdBlue consumption, etc.

Depending on the package solution, a display screen and keyboard may also be included. The equipment can be connected to a palmtop, laptop or barcode reader, for instance, and is approved for ADR vehicles. The software is updated remotely. The driver can also have access to the Internet on board. The office and driver can at all times communicate with each other via text messages. Information about the vehicle and driver is sent to Dynafleet's database where it is analysed and presented in clear text in the form of various reports.

5.5.3 Navigation Devices For Heavy Duty Vehicles

In February 2011 Renault announced the introduction of a truck specific GPS app for smartphone platforms [16], see Figure 13. Similar navigation devices specifically for heavy duty vehicles have also been introduced by TomTom and TeleType in the USA.

Figure 13: Renault's iPhone/Android Solution.

These applications/devices calculate specific routes for commercial vehicles, taking into account all relevant route limitations that may affect safe and efficient route planning for commercial vehicles, such as bridge clearances, narrow roads, truck prohibitions, etc. These systems tend to include traffic and weather information as well.

5.5.4 TomTom OpenLR

TomTom introduced OpenLR™, an open-source and royalty free dynamic location referencing technology, using a new Open Industry Standard with low bandwith consumption for the navigation, mapping and ITS industry. It can be easily adapted to the requirements of system integrators, and the technical community can contribute with their ideas to improve it. This step will facilitate new business opportunities in various areas of ITS, such as traffic information services, map content exchange, and cooperative systems where precise and compact dynamic location information is needed. The map-agnostic feature of OpenLR™ enables reliable data exchange and cross-referencing using digital maps of different vendors

and versions. OpenLR™ will help to enhance existing applications and will generate opportunities for new services.

5.6 Encouraging Innovation In The NSR's Road Freight Transport Sector

The data collection, integration and distribution capabilities of the NS FRITS system are likely to act as a catalyst to encourage innovation in the NSR's RFT sector in the same way as earlier ICT innovations in other business sectors have encouraged innovation. The main innovations are expected to be due to the new technological capabilities of the NS FRITS system being used to develop innovative soft products and service solutions. In addition innovations will probably result through targeting what to date has been an under-represented market segment in terms of ICT services, and in particular SME RFT operators. Ultimately, the service would be expanded beyond the NSR and some services could be developed beyond the current target market of the RFT sector.

Innovations could be developed from the information integrating and multi-lingual translation capabilities of the NS FRITS system. These technologies would facilitate the assimilation of data from a wide variety of languages and sources, and the presentation of it to the user in the language of their choice. The latter capability could also be a weakness of the system depending on the quality of the translated material, and the need to avoid factual errors particularly in relation to legal matters, e.g. driving laws.

In addition to innovations derived from the new technology that the NS FRITS systems offers, innovations could arise from the new grouping of actors linked to the system. The grouping comprises the full RFT chain, and many actors from outside who have not previously been focussed on ICT for the RFT sector. Such outside actors include telecommunications operators, equipment manufacturers, service providers, highway and other infrastructure managers/ authorities, security and emergency services, insurance companies, road safety organisations and user associations, etc. The involvement of new information providers in ICT applications, particularly with respect to RFT applications, will doubtless encourage further innovations, e.g. security services, customs services, ferry operators, etc, etc.

The ability of the system to generate two-way data flow could encourage many innovative services based on the system, e.g. the vehicle based platforms could return traffic flow data to generate a predictive journey time module/database.

A key element to encourage innovation in ICT services for the RFT sector will be to ensure that where necessary legislation is adapted and harmonised across the NSR to avoid creating barriers to innovation. In particular regulatory aspects affecting privacy and data protection laws, security, and seamless network roaming and charging may require review.

New international standards may be required to encourage interoperability across borders and between different players in the RFT sector.

5.7 Encouraging Increased Use Of ICT In The NSR's Road Freight Transport Sector

User acceptance has been the key to success in many ICT related initiatives, which in turn has led to the increased use of ICT. Work on road-user charging has found that systems must provide [17]:

- A clear understanding of the individual customer experience to deliver a system that is simple, quick, secure and beneficial for all users,
- The right balance of technologies integrated on an open platform that can respond to constantly evolving customer needs.

Drivers and operators want reliable, easy to use systems that work for them as individuals delivering benefits in terms of cost, convenience, and service enhancements. By providing them with a good ICT experience it will give them more encouragement to explore other ICT applications.

Data collection, integration and distribution can help increase the use of ICT in the RFT sector, for example, by being the basis of services that offer increased safety, security and operational efficiency. The same features may also be used to decrease the environmental impact of RFT. If real, tangible benefits can be derived by actors in the RFT business then the success will prompt investigation of other ICT applications in the sector, especially amongst the previously hard to target SME operators. Innovations leading to the increased use of ICT in the RFT sector can be expected as a result of NS FRITS' unique capabilities and by the involvement of actors from the full RFT chain taking advantage of its key functionalities, e.g. information integrating technology and multi-lingual translation capabilities.

Large corporate users in the RFT sector already use ICT to varying degrees, however, it will initially require the uptake of large corporate users to build a critical mass allowing SME to share in the benefits offered by ICT to the RFT sector.

A balance also has to be struck in terms of providing a reliable system [17]. Advanced technologies may meet the expectations in terms of user requirements, however, they may not be completely stable. On the other hand proven technologies that can be relied upon to work could quickly become obsolete.

A key aspect in encouraging increased use of ICT in the NSR's RFT sector through data collection, integration and distribution will be the promotion of ICT by public bodies. Public bodies could aid the general promotion of the benefits and synergies to be gained by the use of ICT, and in particular by targeting and supporting SME operators to achieve greater efficiencies. This could include support through government grants to SME, etc, to raise awareness of ICT benefits and to enable businesses, especially SME, to improve their products, services and business processes. Public bodies are uniquely positioned to support increased use of ICT through data collection, integration and distribution by removal of societal and business barriers to adopting ICT. For example, public bodies can support the adaption and harmonisation of legislation across the NSR to avoid creating barriers to the uptake of ICT in the RFT sector. In particular regulatory aspects affecting privacy and data protection laws, security and seamless network roaming and charging may require review. A key supporting role of public bodies will be to avoid conflicting policies between the many agencies that are likely to be involved.

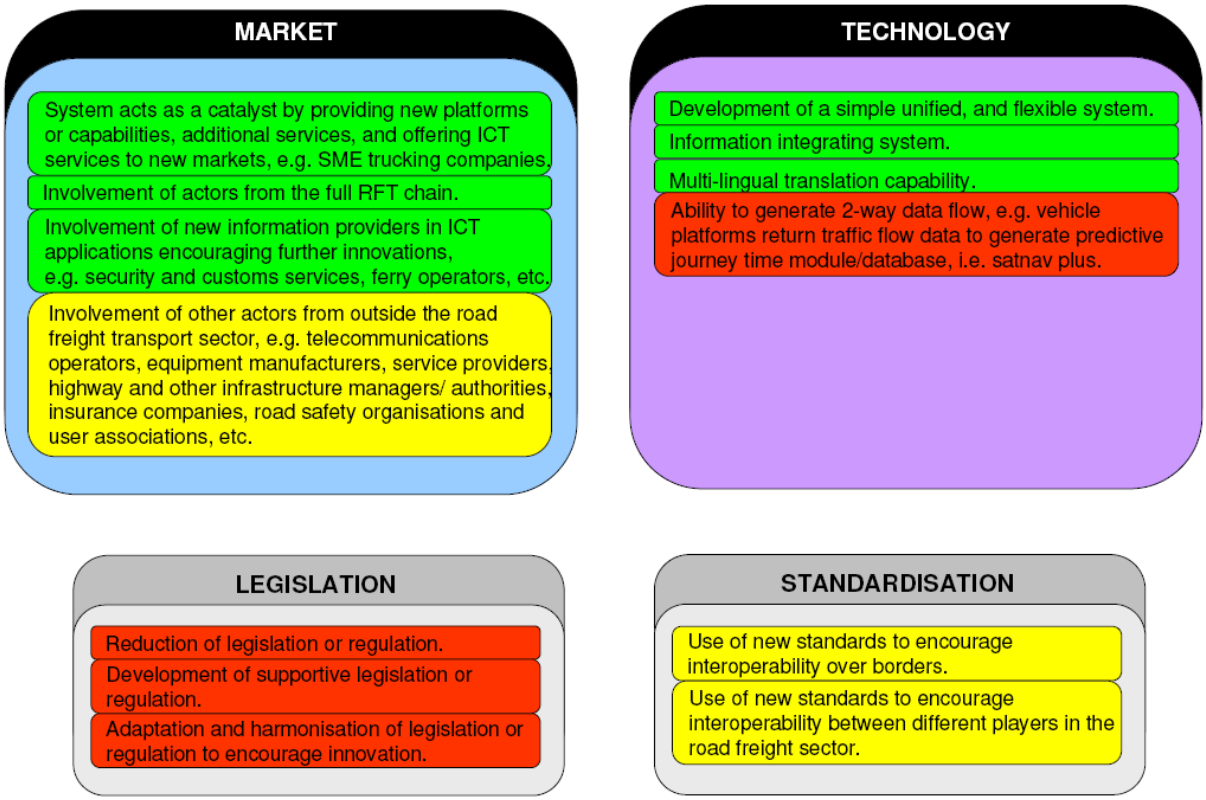
New international standards may be required to encourage interoperability over borders, and between different players in the RFT sector.

6 CONCLUSIONS

Some larger transport companies and service providers in the RFT sector, such as ports, already use limited ICT systems for specific tasks, and advanced ICT solutions for the RFT sector are being developed in a number of collaborative European projects. However, the systems are very fragmented and only provide solutions to individual or a limited number of the services that RFT operators need. This fragmentation of ICT solutions inhibits wider ICT take up due to the increased costs associated with the fragmented systems and the infrastructure required to operate them. In addition fragmented systems can increase driver workload with road safety implications. In contrast, NS FRITS is an integrated concept bringing together data collection, integration and distribution which are merged into a single

ICT solution. The main concept is to provide more efficient information exchange between the driver/vehicle/goods carrier, logistics management and data providers. Through integration of value added services the NS FRITS solution brings an unprecedented range of relevant information directly to the driver while on route, and also enables enhanced real time two-way communication between the various actors in the RFT logistics chain. The key to the NS FRITS approach is to bring together a number of data sources that have been selected on the basis of the outcome of a number of questionnaires in the NSR. The data received from those sources is integrated via a central system, and then distributed cost effectively by using existing telecom infrastructure and platforms (tablets).

NS FRITS encourages innovation in the RFT sector by offering a trans-national solution that collects, integrates and distributes data from a wide range of sources, including a two way communication capability. Using these features as the basis, it is probable that with adequate development the NS FRITS system could be the platform for many service innovations in the RFT sector and beyond. Figure 14 shows the main mechanisms for encouraging innovation in the use of ICT by the RFT sector.



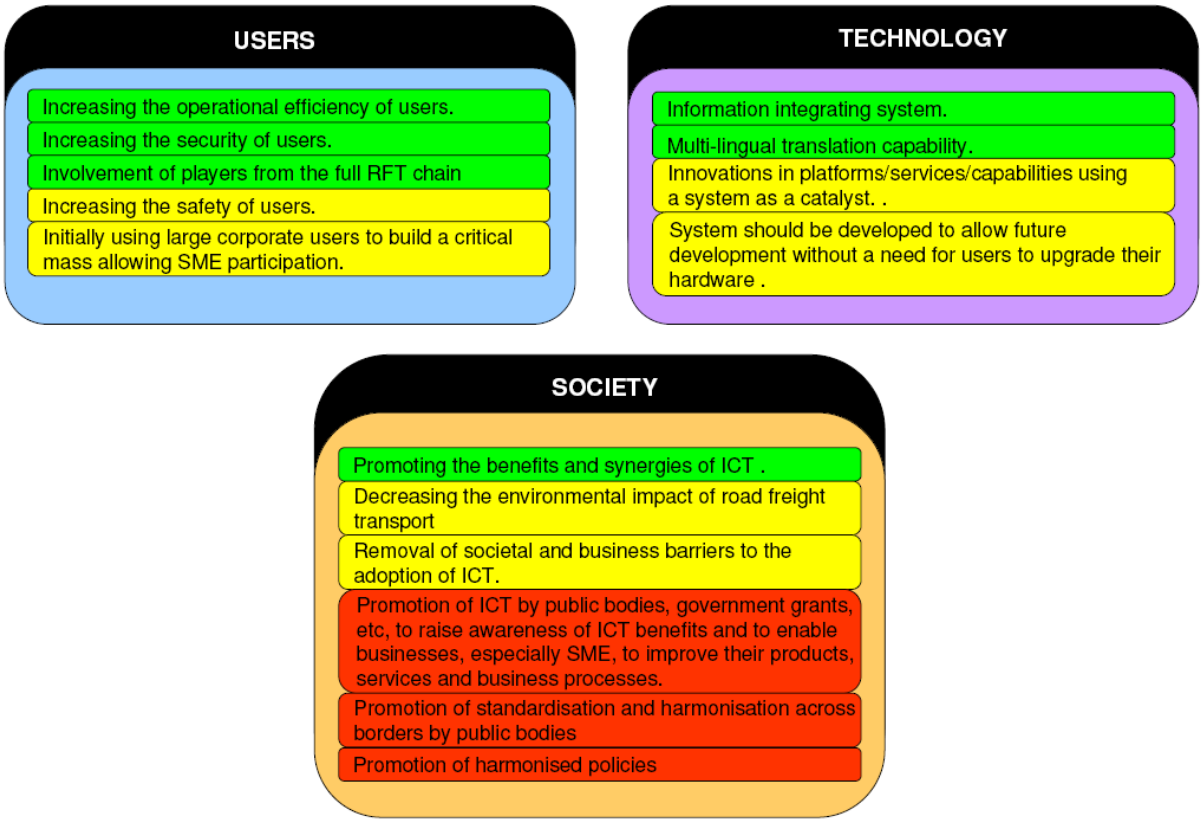
Box colour key:
Green – Addressed by NS FRITS
Yellow – Partially addressed by NS FRITS
Red – Not addressed by NS FRITS

Figure 14: Mechanisms For Encouraging Innovation In The Use Of ICT By The RFT Sector

Many issues need to be adequately addressed to encourage the increased use of ICT in the RFT sector, and among the most prominent of these are the need for user acceptance, secure services, and the promotion of ICT services to the RFT sector and in particular to SME operators. The need for services dealing with security issues has, however, to be balanced against recognition that the technology can be used in an intrusive manner which may be of particular concern to drivers and the SME sector. The challenge is to achieve a

balance such that the intrusive aspects of the system do not become unacceptably so, and in particular to understand what is acceptable which vary from operator to operator.

To encourage increased usage of ICT the NS FRITS system needs to develop user acceptance by providing multiple value added services that are enabled by the system, and to allow data providers to plug-in easily to the system. Data sources need to be vetted to ensure that they provide accurate and current data. The system also needs to be robust and stable to ensure 24/7 availability. It also needs to be developed so that it can respond to needs as they evolve, and to allow future development without a need for users to upgrade their hardware. Increased use of ICT through data collection, integration and distribution can be encouraged by the mechanisms shown in Figure 15.



Box colour key:
Green – Addressed by NS FRITS
Yellow – Partially addressed by NS FRITS
Red – Not addressed by NS FRITS

Figure 15: Mechanisms For Encouraging Increased Use Of ICT Through Data Collection, Integration And Distribution

A key question to be addressed is how innovation and the increased use of ICT in the RFT sector can be stimulated after the lifetime of the NS FRITS project. One project that has been identified was the BESTUFS II project. BESTUFS II is a follow-up initiative of the successful BESTUFS project to identify, describe and disseminate best practices, success criteria and bottlenecks with respect to City Logistics Solutions (CLS) The project aims to maintain and expand an open European network between urban freight transport experts, user groups/associations, ongoing projects, the relevant European Commission Directorates and representatives of national, regional and local transport administrations, and transport operators. The results of NS FRITS could be presented to the network, and it could be used to explore how the use of ICT in the RFT sector can be further encouraged.

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APPENDIX 1: NS FRITS COLLABORATIVE PROJECTS

As part of the work to produce the "NS FRITS Technical Concepts" document [9], many projects were researched to establish if they were relevant to NS FRITS. Following this work, the projects listed in Table A1-1 were identified as being most relevant to NS FRITS activities [10].

Table A1-1: Projects Identified in the NS FRITS Technical Concepts Document As Being Most Relevant To NS FRITS

Project name	Funding body	Description	Website	Reason
Dryport	Interreg IVB	To support port capacity by improving hinterland distribution hubs and looking at the potential of 'inland ports' with multimodal connections	Dryport	Synergy with StratMoS
EasyWay	DG TREN	ITS deployment on main TERN corridors, identifies necessary ITS services to deploy (traveller information, traffic management and freight and logistic services).	EasyWay	Several contacts with the project via KLPD
Heavy Route	FP6	Develop an advanced HGV management and route guidance system	Heavy Route	Already involved in the project
Integrity	FP7	Intermodal global door-to-door container supply chain visibility	Integrity	ISL is coordinating the project
Label	DG TREN	Creating a LABEL for (secured) truck parking areas along the trans-European road network and defining a certification process including online information facility	-	Working with TruckInform
Rising	FP7	River information services for transport and logistics	Rising	ISL is coordinating the project
SETPOS	DG TREN	Secure European truck park operational services	SETPOS	Working with TruckInform
SISTER	FP7	Satcoms in support of transport on European roads	-	Lead partner in SISTER

SMARTFREIGHT	FP7	Specify, implement and evaluate ICT solutions that integrate urban traffic management systems with the management of freight and logistics in urban areas	SMARTFREIGHT	Closely linked with NS FRITS aims and objectives
StratMoS	Interreg IVB	Promote and facilitate shift of cargo from road to sea-based intermodal transport, and improve accessibility by supporting the implementation of Motorway of the Sea (MoS) and related transport networks in an integrated logistical chain.	StratMoS	Already agreed at StratMoS meeting
STREETWISE	DG TREN	Seamless travel environment for efficient transport in the western isles of europe	-	TBC

APPENDIX 2: OTHER PROJECTS RELATED TO NS FRITS

As part of the work to produce the "NS FRITS Technical Concepts" document [9], many projects were researched to establish if they were relevant to NS FRITS. In addition to the projects listed in Table A1-1 which were identified as being most relevant to NS FRITS activities, the following projects were also identified as having some relevance to NS FRITS. In addition a number of other European and national projects have since been identified which are indicated by the turquoise highlight in the list below.

- AIDE - Adaptive integrated driver-vehicle interface
- ARENA - Swedish project supporting the national strategy for road charging also undertaking research in the field of e-transactions
- ARTS - Advanced road traffic in south-west
- BESTUFS II – Best urban freight solutions
- CENTRICO - Central european region transport telematics implementation project
- CHINOS - Container handling in intermodal nodes optimal and secure
- CHORIST - Integrating communications for enhanced environmental risk management and citizens safety
- CONNECT - Co-ordination and stimulation of innovative ITS activities in Central and Eastern European countries
- COOPERS – Co-operative systems for intelligent road safety
- Corvette Tempo - Co-ordination and validation of the deployment of advanced transport telematic systems in the alpine area – trans-european intelligent transport systems projects
- CVIS – Co-operative vehicle-infrastructure systems
- East-West Transport Corridor - Develops efficient, safe and environmentally friendly handling of goods being transported east-west in the southern Baltic region
- e-Freight - European e-Freight capabilities for co-modal transport
- ERTICO - Network of intelligent transport systems and services stakeholders in europe
- ESAFETY FORUM - aims to promote the development, deployment, and use of Intelligent VEhicle Safety Systems to enhance road safety throughout Europe
- EURIDICE – European inter-disciplinary research on intelligent cargo for efficient, safe and environment-friendly logistics
- FLAGSHIP – European project, focusing on improvement of safety, environmental friendliness and competitiveness of European maritime transport. The FLAGSHIP-RTS sub-project develops a system, which is a next-generation scheduling and optimisation solution designed specifically for the container logistics industry.
- FREILOT – Urban freight energy efficiency pilot
- FREIGHTWISE – Management framework for intelligent intermodal transport
- GILDANET - Global integrated transport logistics data network
- GOOD ROUTE - Dangerous goods transportation routing, monitoring and enforcement
- ICT For Cargo On The Road - Studies how road user charging systems for HGVs can be integrated with other value added services in Sweden
- IST-MIDAS – Middleware platform for developing and deploying advance and mobile services
- MADAMA - Risk Management Systems for Dangerous Goods Transport In Mediterranean Area
- MARNIS - Maritime navigation and information services
- Mataari - Improving mobility and accessibility to transport and logistics services between urban areas and intermodal centres
- PARFUM –Particulates, Freight and Heavy Duty Vehicles in Urban Environments
- PROMIT –Promote Innovative Intermodal Freight Transport

- SAFESPOT – Co-operative system for road safety 'smart vehicles on smart roads'
- SERTI - Southern European road telematics implementation
- SEVECOM – Secure Vehicle Communication
- SMART-CM –Smart Container Chain Management
- START – Short Term Actions to Reorganize Transport of Goods
- SUGAR – Sustainable Urban Goods logistics Achieved by regional and local policies
- Truckinform – the European truck parking information portal
- VIKING - Co-ordinates national and bi-lateral traffic management schemes, and implementation of Intelligent Transport Systems (ITS) in Scandinavia (Denmark, Sweden, Finland and Norway) and five regions in northern Germany