D7.2 Advanced transport information service models

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Executive summary

In ROADIDEA new advanced services based on transport information are innovated and developed. The new services are planned to create increased value to end users and other stakeholders. Since not all advanced services can rely on public funding, also the financing and earning models need to be considered. This deliverable reviews the business models of the ROADIDEA pilots and ideas and summarizes lessons learnt from them.

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1. Introduction

1.1 Objectives

ROADIDEA (www.roadidea.eu) aims to innovate and develop advanced information services to support road traffic in all its forms. The advanced information services are based on the idea of integrating different types of information to create added value. In addition to the challenges of data collection, aggregation and presentation, a need to review and assess different possibilities of business models and value chain structures for these services has been identified.

The objective of this WP7 (Business modelling) is to analyse, develop and assess business models of information services. This includes context-dependent identification of different stakeholders and their expectations and benefits to define potential business roles (for example information brokers) in the transport information service area. Generic business model approaches are applied for the definition of the components of (potentially) different information service business models. [RI_TA, 2007]

The previous deliverable D7.1 presented the results of an information collection of current European transport information service business models. This report applies the same business modelling framework to ROADIDEA "real" pilots (chapter 3.1-3); pilots with implementation and testing. A simplified version is applied to "theoretical" pilots, assuming they were finalized (chapter 3.4-5). Additionally an overview of the users and business potential of the ROADIDEA ideas is presented in chapter 4. Chapter 5 presents the lessons learnt from ROADIDEA, form the business modelling viewpoint.

1.2 Links to other work packages

Figure 1.1 presents the interdependencies between ROADIDEA work packages as identified in the Technical Annex [RI_TA, 2007].

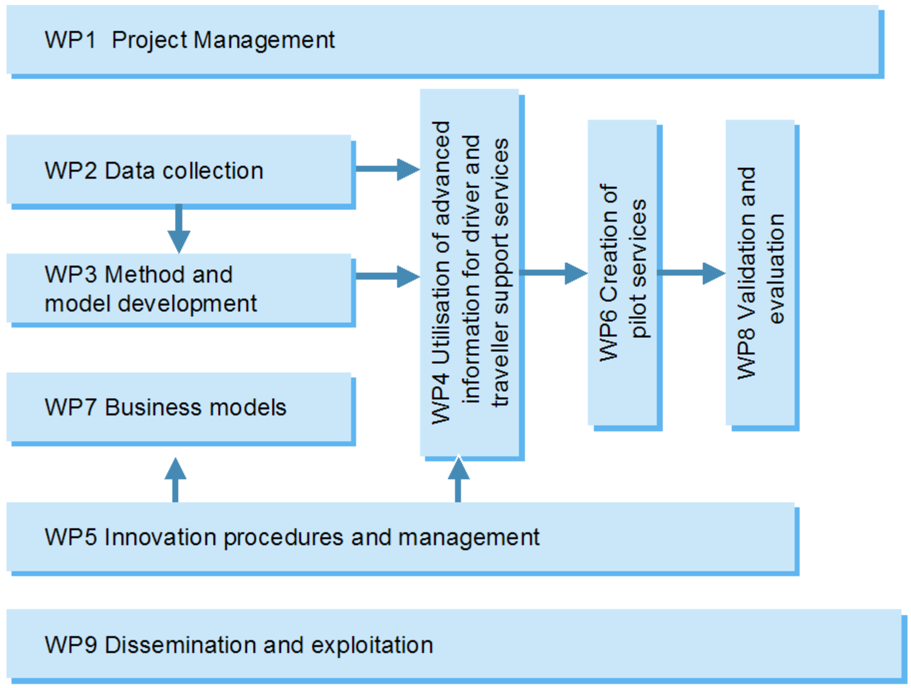

Figure 1.1. The interdependencies of the ROADIDEA Work Packages.

In addition to those identified in the project planning phase the business model has links also to other work packages:

- WP2 "Data collection" has given information about data availability, sustainability and pricing which is relevant for business modelling:

D2.1 presented the results of the data source investigation [ROADIDEA D2.1 2008]. Additionally WP2 has offered also information about the availability, accessibility and data charges and license fees. These topics also have to be taken into consideration during the integration of available data sources into the project pilots during the pilot implementation in WP6, which is also linked very closely with the generation of business models in WP7.

- WP4 studying the advanced information is also reviewing the user requirements for advanced transport information

- WP6 develops and describes the pilots, the business models of which are presented in this deliverable.
- WP8 pilot evaluation takes into account also the business sustainability viewpoint.

2. Describing business model

In ROADIDEA the following definition [Osterwalder et al. 2005, also used in Wikipedia] of business models has been used:

"A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams."

Based on this, a template for the description of transport information service business models was developed and applied to selected existing transport information services in D7.1. The template consists of the following titles:

- Description
- Stakeholders and their roles (users, financiers, information providers, other service providers)
- Service value for users and financiers, cost items, revenue logic and finance
- Data sources; sustainability, availability and pricing
- Service network description: different stakeholders and the information and money flows between them

In D7.2 the same description template is used for ROADIDEA "real" pilots, i.e. pilots that have been implemented as a prototype. The pilots at a more conceptual phase, with partial implementations, are described with a simplified template, including:

- the objective of the service
- main information contents
- potential users'
- benefit / value for users or other stakeholders
- Service providers and financiers
- Information providers and other service providers

3. Business model descriptions of ROADIDEA pilots

3.1 Merging of Traffic and Weather Data in Gothenburg Area

3.1.1 Description

The main purposes of the pilot are:
• Create a traffic flow prediction model
• Study the data from a research perspective
• Collect a history database about traffic flow data
• Investigate what kinds of algorithms are possible to use for this specific pilot
• Investigate the key factors that might be of value and have an impact on the Gothenburg pilot.

The capacity of the roads in many cities has not grown as rapidly as the traffic flow has increased and this requires big efforts to meet the traffic needs now and in the near future.

To test the ideas, Gothenburg is proposed as a ROADIDEA pilot, due to data access from several sources in the area and also that both the Swedish ROADIDEA partners, Semcon and Klimator, are located there. In practical case the pilot uses data from Swedish Road Administration (Vägverket) to make traffic flow predictions.

Gothenburg's traffic situation is quite specific since the city is separated by a river and there are only three connections over the river close the city (figure 3.1), the last one built forty years ago. Since then, more roads have been built in Gothenburg but no more connections over the river. This causes a lot of traffic problems and might be typical for other cities with growing transport needs as well.

The key research question of the pilot is how the use of modern technology can result to a better traffic situation when making analysis with historical data. A very important part of the pilot is to evaluate the traffic flow prediction model.

In this pilot a traffic flow prediction model, process and XML interface to UI will be created and demonstrated. The model will use both historical model data and real time data (like traffic density and traffic speed). Real time data will be used on a specific algorithm and as a result will be current traffic flow and a prediction of the future. The model uses traffic flow information that is collected to historical database together with real-time calendar data. This data is categorised into three different types of date: workdays, Saturdays and holidays. The data in these categories are re-categorised into half an hours time periods. These results are saved into static database that is used in comparisons with real-time traffic flow data.

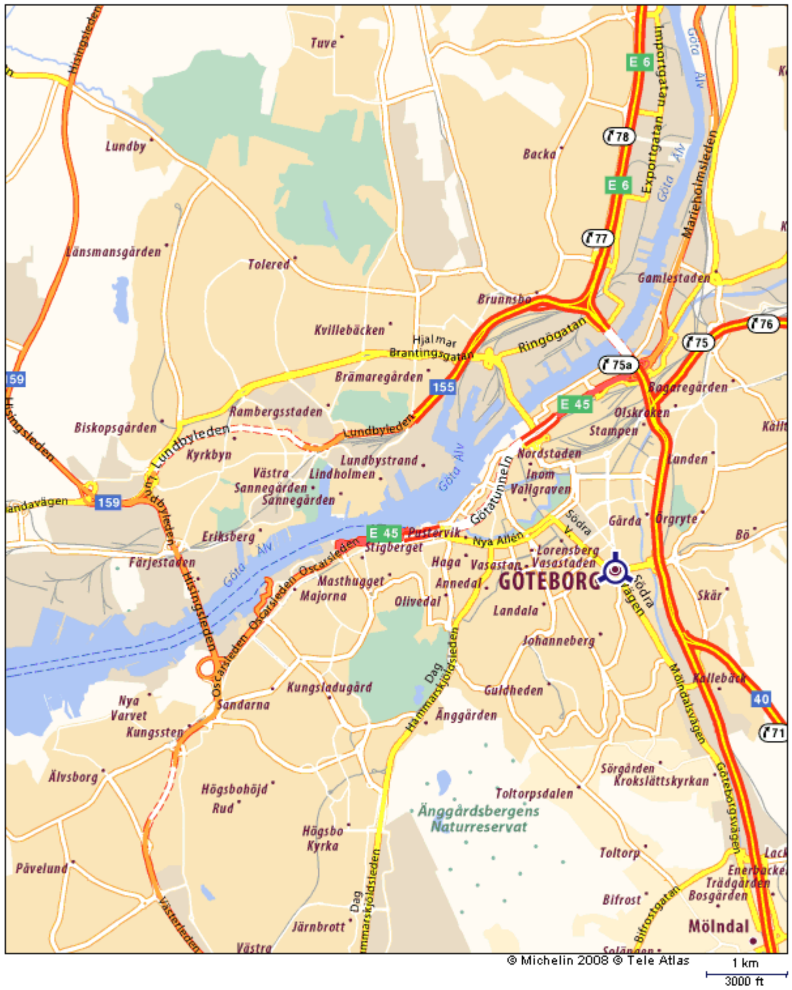

Fig. 3.1 Map of Gothenburg.

The end user case of the pilot will be a mobile application, which illustrates both the current traffic flow and traffic flow prediction. The application will be realised by Lociga. Destia will support the process by serving all the input data that comes from the pilot. All the mobile application records will be saved to Logica's database to be used e.g. in the predictions.

3.1.2 Stakeholders and their roles (describe potential case(s))

Stakeholders and their roles are explained on the figure 3.2 and tables 3.1 and 3.2.

Users of the information system (who uses the information)

Potential users of the service are road users, traffic information service providers, road managers and local authorities.

The basic user need behind the service is the need for more accurate traffic information before and during the trip. The major problem to be solved with the service is congestion and congestion related problems in the cities. The primary target customer group of the service consist of road users and traffic information service providers. Other potential customers are road managers and local authorities.

The end user case of the pilot will be a mobile application which illustrates both the current traffic flow and traffic flow prediction.

Financiers of the information system (who pay(s) the costs)

End users in some form are the main financiers of the service. The service can be provided to private customers directly or an organisation, like a company, can offer the service for its employers or customers. In the beginning it is likely that some kind of support from a public authority (e.g. city of Gothenburg or Swedish Road Administration) is needed. Later on advertiser(s) will compensate the public financing.

Information providers

The pilot is based on traffic information data and road weather information collected by Swedish Road Administration. Other third party information providers supplement public agency data collection. Destia acts as the aggregator of all information collected from different sources and processes it so that the feed can be used by the mobile application developer.

Other service providers

Third party software providers are necessary for developing or deploying the service. In this case the service will be managed by Logica. Also any additional data from third party sources will be aggregated into the service by Logica.

The service will be optimized for mobile device access and requires the service operator. In this case where traffic and weather data in Gothenburg area is piloted, the service operator could be some telecom operator. Here the service operator is not specified.

Third party aggregator's role is similar like data aggregator's (Destia). They buy data from the data aggregator, process it and sell it forward for third party software provider and service operator. Here the third party aggregator is potential and not specified.

3.1.3 Service Value & costs & revenues

Service value for users

The service will reduce the duration of journeys because it will reduce congestion. Also the costs caused by traffic and transportation will be smaller if the congestion problem can be diminished.

The service includes information about occurred incidents. That will make incident management as well as incident prevention easier. The service will also improve traffic safety (because of smoother traffic) and reduce the amount of emissions.

Service value for financiers

Service value for end users is described in the previous chapter.

In addition, from the public financier's point of view, the service can help to reduce the need to build new transport infrastructure and to direct the transport infrastructure maintenance and operational resources to the most essential issues.

Description of service cost items / sources of costs

The service requires investment costs (establishment of the service, server costs, developing costs of user interface), annual maintenance costs and some operational costs.

The source data is provided by a public sector actor (Swedish Road Administration). The data is used in several services and purposes and would be collected anyway and so the service does not cause any new costs for public sector actors.

Revenue logic and finance

To establish and start the service, a start-up financing is needed. In this case, the start-up financing is from public sector.

3.1.4 Data sources; sustainability, availability and pricing

To build up this pilot, several different data sources are going to be used and combined with new and improved algorithms.

- **Traffic Information from Sensors and Cameras**

Gothenburg has a lot of sensors and cameras to measure the traffic and include several parameters such as speed, flow, number of vehicles, distance between vehicles etc. These parameters are sampled in a period of one minute and stored in a database of the Swedish road administration. For this specific pilot one minute data have been requested for the whole period of a selection of important gateways of the roads with high amount of traffic.

- **Road Weather Information**

VVIS (Road Weather Information System) is the Swedish Road Administration's system to measure weather on the Swedish roads. There are about 700 stations around the country to measure road and air temperature, dew point, air humidity, precipitation, wind speed and wind direction etc.

3.1.5 Potential Service Network description

Figure of Service Network

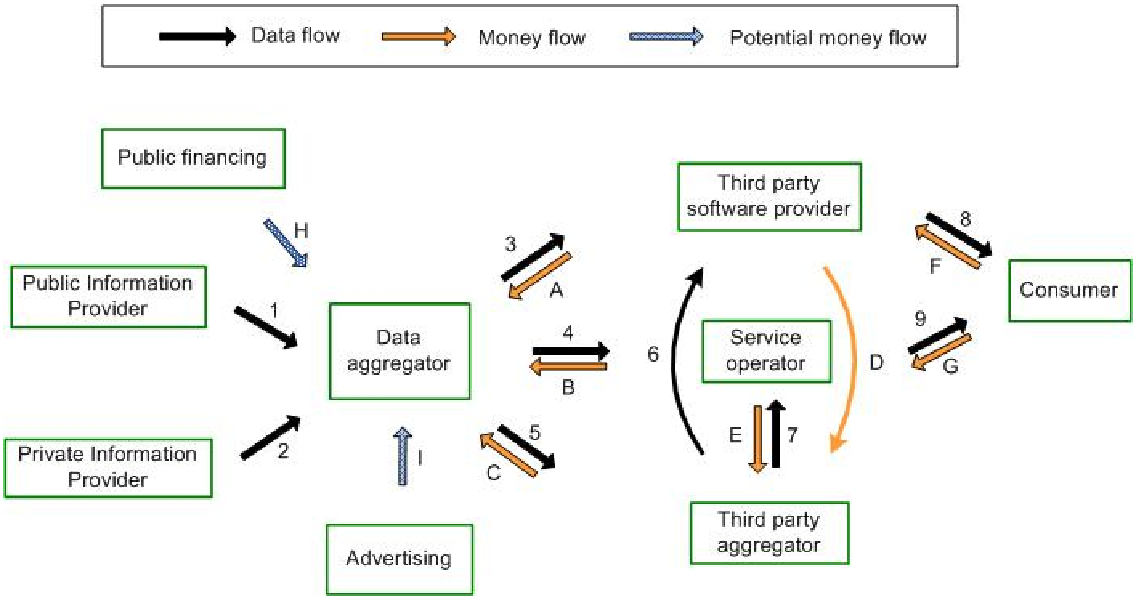

Fig. 3.2. Business model of Gothenburg traffic and weather information service (ROADIDEA pilot 2).

Description of flows in the figure:

Table 3.1. Principal data and information flows.

Data & Information Flows	
Number	**Description**
1	Public traffic and weather data – Swedish Road Administration
2	Data from private sources
3	Pre-processed data from data aggregator (Destia) to third party software provider (Logica)
4	Data feed from data aggregator to service operator
5	Selected data types (e.g. weather information) from data aggregator to third party aggregator
6	Processed data from third party aggregator to third party software provider
7	Processed data from third party aggregator to service operator
8	Processed data to consumer as service
9	Processed data to consumer as service

Table 3.2. Principal money flows.

Money flows	
Letter	**Description**
A	Software provider's payments to data aggregator
B	Service operator's payments to data aggregator
C	Third party aggregators' payments to data aggregator
D	Third party software providers' payments to third party aggregator

E	Service operators' payments to third party aggregator
F	Consumers' payments to third party software provider (Can be the same customer as on row G)
G	Consumers' payments to service operator (Can be the same customer as on row F)
H	Potential money flow from public sector
I	Potential money flow from advertisers

3.2 Pulp Friction- pilot

3.2.1 Description

Icy and slippery road conditions may exist on high latitude and altitude regions several months during wintertime. The risk for car accidents is much higher in slippery than in dry and clear condition. Road maintenance activities try to ensure good driving conditions for drivers. Two main maintenance activities are salting and ploughing. Salting melts existing ice on the surface and pre-icing prevents wet surface to become icy when road temperature decreases below zero degrees Celsius. Snow on the surface is taken away by doing ploughing operations.

In the road weather warning service, which is operated by Finnish Meteorological Institute (FMI) and Finnish Road Administration together, the road conditions are divided into three categories: normal, bad and very bad road conditions. There is a link between friction and road conditions: friction above 0.3 means normal road conditions, friction 0.15…0.3 bad road conditions and friction below 0.15 is linked to very bad road conditions.

In FMI there is a road weather model in use and the model forecasts e.g. road surface temperature and road condition. The model is a tool for meteorologists when they are doing road weather forecasts. Also, road maintenance personnel use the model when planning road maintenance activities.

The road weather observation network consists of about 520 stations along the Finnish main roads. Almost 100 of them are installed with Vaisala DSC111 sensor which measures optically the thickness of water/ice/snow on the surface and makes an estimation of prevailing friction as well. Friction is a grip between the road surface and tyres. Usually the value of friction is between 0.1 and 0.8 on the road surface.

Pulp Friction pilot is considering friction. The main work of the pilot is to develop a model which forecasts friction on the road surface. The developed friction model is a statistical model based on observations measured in road weather stations installed with Vaisala DSC111 sensor. Observations are available from last winters. Measured values have been studied, for example a correlation between thickness of water/ice/snow and prevailing friction have been found.

The first version of the model has been developed and the model is in operational use now. The friction model is part of FMI's road weather model. The model is running for points installed with DSC111 so the verification data is available. Modeled friction values will be comprehensively verified after 2009-2010 winter season.

The main purposes of the pilot are:
• Study the phenomena of friction
• Find correlations between road weather and friction by studying the observations measured in road weather stations installed with optical sensor (Vaisala DSC111)
• Develop FMI's road weather model to take into account friction so that friction will be a new output of the model
• Develop a road weather warning and monitoring tool

3.2.2 Stakeholders and their roles

Users of the information system (who uses the information)

The outcomes of the studies will be aimed for the road maintenance personnel and meteorologists to help monitoring prevailing road weather and to estimate the prevailing and forecasted road weather. Also, some products based on friction or processed friction can be developed for drivers later.

Information providers

Finnish road weather observation network consists of about 520 stations (situation in November 2008). Almost 100 of those stations are new types of optical sensors which give an estimation of prevailing friction on the surface, too.

Other service providers (operators, device manufacturers...)

Road weather observations will be delivered by Finnish Road Administration. FMI will develop the road weather model and the data will be delivered to Destia's platform.

3.2.3 Service Value & costs & revenues

Service value for users

It is known that the state of the road as well as friction can vary dramatically even within short distances. That can cause difficult driving circumstances for car and truck drivers. Good observations and modern road weather forecasts and warnings help drivers to take into account bad driving situations. Nowadays road weather models can determine the state of the road so it would be useful to take into account the value of the friction because there are friction observations available nowadays. With the help of more precise and better road weather forecasts driving is safer and the winter maintenance activities more effective.

3.2.4 Data sources; sustainability, availability and pricing

Friction measurements are available from last years. For example Finnish Road Administration has installed Vaisala's optical road weather sensors which define also friction. Those measurements are available for ROADIDEA project and can be compared to the prevailing weather situation and other road weather observations. Those observations give lots of information when developing the friction model.

3.2.5 Business assessment of Pulp friction pilot, mobile application

Short description / ontology:

The Service consist of three different parts (Figure 3.3) :
1) Source data environment / server, 2) Roadidea Platform / server and 3) Mobile delivery platform.
1) is hosted by FMI, 2) by Destia and 3rd by Logica.

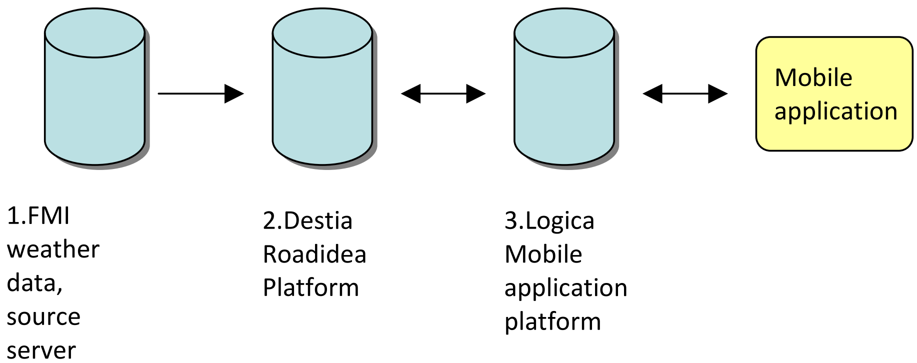

Fig. 3.3 Overview of production model

The service is a mobile application (Symbian S60 3rd). After downloading the application the user can have a access to a dynamic map which shows 91 Pulp Friction measurement points and their data. Data is obtained by application from Mobile application platform which requests data from Roadidea Platform. The Roadidea Platform is independent from devices, the data can be sent or requested for use from many channels via http/xml. In this case Logica application platform is used.

The application provides road friction information which is understandable from the driver point of view. The data is illustrated from user perspective to show the slipperiness of the road. The application itself is location based: it uses manual / gps positioning.

FMI holds the rights to source data, Destia holds the rights to Roadidea platform and Logica to mobile server and application. The application can be licensed to a service provider in the commercial phase (e.g. to Destia). In the commercial phase maintenance and liability are according to agreed SLA (Service Level Agreement). In the pilot phase no SLA for maintenance and liability are given nor customer legal notices are taken into account.

Background and objectives:

The main objective is to warn drivers about exceptional winter road conditions (slipperiness) and to reduce number of accidents, to add awareness of road friction conditions.

Wintertime accidents caused by hazarduous conditions, example from one year in Finland:

Altogether 254 fatality accidents in which, 283 fatalities
At the moment of the accident the road surface was:
in 24 % of the cases slippery (61 acccidents)
Icy 16 % (40 accidents)
Slushy 4 % (9 accidents),
Snowy 3 % (7 accidents and
water in grooves 1 % (3 accidents)

Costs And Price Of Service (Pulp Friction Mobile Application)

Costs for planning and specification and investment costs for mobile application development
est. 60000€ (for full scale commercial launch, mobile application and localisation only)
+ est. 20 000€ for the platform; Roadidea server development.

Technical maintenance costs
est. 5000-10000€ for mobile platform and applications (new S60 versions, updates, patches)
Operational costs
12000€ /y (Mobile platform costs)
6000€ / y (Roadidea server platform allocated costs)
- € / y (FMI source data costs, cannot be allocated, public sector domain)

Estimated actual service price for 3 years lifespan period 4000€ / month (including investment amortization)

Cost-Efficiency Of Service

Potential service users
10-30000 (early adopters)
Pricing model 3-5€ per month if commercially launched

Cost efficiency can be estimated also from socio-economical point of view. The hypothesis is that the service will enhance driver awareness of road friction conditions and hence increase traffic accidents, even fatal incidents. In this case the indirect socio-economical impact would be significant.

3.3 Route Rainfall Prediction -pilot

3.3.1 Description

The Demis rainfall prediction route planner is a cooperative web based routing database for trip planning, including dynamic weather integration. Way finding is a key aspect of travel of all kinds, but the costs of inaccurate information are highest for human powered transport and weather-exposed transport modes (bicycles, pedestrians, scooters, moped and motor cycles). This demonstration service developed in ROADIDEA combines existing elements from EC projects such as REORIENT, WORLDNET, ETIS-PLUS and the Demis software for on-line route planning and on-line GIS network editing with rainfall predictions for the Netherlands as an illustration of a future service. It can be found at http://www.roadidea.eu/pilots/pages/pilot5.aspx .

The service consists of different key elements that address specific information needs and shortfalls, as well as linking this with several ROADIDEA Ideas:

1. **MyRoute, Mobile Pocket Guidebook**: My Route Mobile Pocket Guide is a system for providing travel information and updates over a mobile network. It gives the traveller / driver comprehensive real time traffic information needed for well-informed travel decisions (pre-trip information) as well as information during the journey (on-trip). As a demonstration of the kind of pre-trip service discussed in this ROADIDEA idea, there now is an operational ROADIDEA web site for a Route Rainfall Prediction in Holland. It uses rainfall prediction 1 by 1 km grid data up to two hours ahead to prediction the amount of rainfall given a certain departure time. This kind of prediction is important for road exposed to the weather, such as bicyclists, motor cyclists, scooter drivers and pedestrians.
2. **MyTravel, TOILET-TOMTOM**: My Travel Toilet Tom-Tom service is offered to all drivers and travellers. It gives a driver / traveller the possibility to find information on availability of toilets along a planned route, with particular impact on places for disabled persons and mothers with small children. It could also give the driver / traveller possibility to check the other resting possibilities at chosen place. Although My Travel Toilet Tom-Tom idea could seem a little bit frivolous, the service will have impact on the state of mind of the driver, and thus reduce driver's nervousness, inattentiveness, uneasiness, and so reduce the risk of incidents. My Travel Toilet Tom-Tom could be integrated in some other Tom-Tom applications regarding travel planning. As a demonstration of this kind of service there is now an operational ROADIDEA web site for a point rainfall prediction in Holland. It uses rainfall prediction 1 by 1 km grid data up to two hours ahead to predict the amount of rainfall on the location of the device that connects with the internet. The device can be a mobile phone, or laptop, or any other device that has a web browser that supports the GeoLocation API. For more information on this see http://www.roadidea.eu/pilots/pages/pilot6.aspx .
3. **Mobile Phones as Sensor**: This idea concerns the use of mobile phones as sensors. One condition for that is that the position needs to be known. The point rainfall prediction demo shows how to use the GeoLocation API to provide a rainfall prediction for the location of the device calling the service.
4. **FREEDATA**: This ROADIDEA idea is not suggesting a new service as such, but a new general data policy that would affect many present and coming transport services in Europe. In principle, Free Data indicates that key data sources for transport services - i.e. weather observations and models, road weather observations and models, traffic volume data, car measurements and other geospatial data - should be accessible and available free of charge (or with minimum copying costs) and in a convenient manner for any service provider for further utilisation. The Route Rainfall Prediction demo shows how to use rider input on a continuing basis to collect free (bicycle) path & road network data. The weather data are provided a 1 by 1 km grid up to two hours ahead by the Royal Dutch Weather Service KNMI. As part of this research project the data is provided for free!

The last item needs further explanation. Demis is the software provider for the most popular bicycle route planning system in the Netherlands. As there no FREE and reliable bicycle path network data in the Netherlands, the Dutch Bicycle Union and Demis decided to develop an on-line GIS where volunteers are editing the needed network data. The Demis on-line GIS network editor (InterNetter) is continuously developed and used in EC-projects such as REORIENT, WORLDNET, and ETIS-PLUS. This allows us to make use of rider input on a continuing basis, and to deliver a bicycle trip planning system that is the more reliable for it. Over 3 million user input network and information input and update edits had been recorded by the end of 2008. The system has been adopted by 6 Dutch provinces, and the number is growing. This successful overall model for harnessing user participant knowledge (aka “crowd sourcing’), linked to what is clearly an ITS system, shows both that ITS has major and appreciated benefits for human powered as well as powered vehicle, and that crowd sourcing is a viable mode of participation in ITS for human powered transport.

Recently, as part of the ROADIDEA EU FP7 project on innovations in transport, a real time link to the Dutch weather service was added, and made part of the on-line trip planning system. This is a demonstration service only, as the underlying network data were not developed fro bicycle route planning and lack information on key bicycle paths.

The rainfall prediction part of the demonstration system allows the user to set an average speed as well as a departure time for a selected trip from an origin, through via-points to a destination. In this way the user can select the best departure time to avoid heavy rain showers.

In this chapter we describe the business model of this type of service. We have assumed here that the operational version of the service will be that the Dutch Bicyclist Union adopts the rainfall prediction as part of their existing on-line bicycle route planning service.

3.3.2 Stakeholders and their roles

Users of the information system

This type service is applicable for human powered transport modes (pedestrian, bicycle) and transport modes that expose the driver directly to weather (scooters, mopeds and motor cycles).

Financiers of the information system

In the Netherlands the Dutch Bicyclist Union organises this service for free on the internet. Provincial authorities fund these planners for a period of seven years. For special developments there have been limited subsidies from Senter-Novem due to the innovative aspect of data collection using “crowd sourcing”, as volunteers help the Dutch Bicyclist union with bicycle network data collection.

Information providers

The information providers are:

1. **Network data**: As a basis for the network the free National Road Data file is used. This is provided for free by the Ministry of Public Works. For a bicycle

network this dataset is incomplete. It needs a lot of editing by volunteers to add proper bicycle path information.

2. **Network link and node attributes**: This is collected by volunteers. It concerns road surface quality, safety, environmental and landscape aspects. These are used to create routes satisfying user-defined criteria in these respects. Part of the data is collected using grids with information of land-use, attractiveness and landscape from the Alterrra institute. They are paid through the provincial funds.
3. **Weather data**: The weather data are provided a 1 by 1 km grid up to two hours ahead by the Royal Dutch Weather Service KNMI. As part of this research ROADIDEA project the data is provided for free! In future arrangements with KNMI need to be made.

Other service providers

As an on-line system the service needs an on-line web server. Currently this is hosted by Demis, but it will be transferred to a server hosted by a standard Internet provider, managed by the Dutch Bicyclist Union.

3.3.3 Service Value & costs & revenues

Service value for users

The service value for users is high. Even the current on-line bicycle planners have attract roughly ten thousand visitors a month. In questionnaires for the member of the Dutch Bicyclist Union they rated an on-line bicycle route planner as the top priority. However they also said that the on-line service should be free.

Service value for financiers

The financiers see the service as part of a policy for sustainable non-motorised transport. They feel they are obliged to provide this service to the general public.

Description of service cost items / sources of costs

Judging from experience a planner costs about 30.000 Euro per province per year. The money is spent on:

- **Coaching volunteers**: the Dutch Bicyclist union hires personnel to do this, costs about 21.000 Euro per province per year (i.e. half time job per province)
- **Software development and maintenance**: In practice about 5000 Euro per year is spent on software maintenance and further developments
- **Hosting**: for hosting the web site per province about 2000 euro per year is needed
- **Data acquisition**: about 2000 euro a year is spent on data acquisition.
- **Rainfall prediction data**: Currently this data is provided for free as part of the ROADIDEA project, but new arrangements need to be made with the KNMI. It is not yet known what this will cost in future.

Revenue logic and finance

The major part of this service is funded by the provincial authorities. As there is no other source of income, this free service can only exist while funded by public means. A commercial service for this is not viable as the users expect this to be a free service.

3.3.4 Data sources; sustainability, availability and pricing

Data sources used are presented in Table 3.3:

Table 3.3. Data sources of Route Rainfall Prediction-pilot.

Source	Data description	Pricing
Ministry of Public works	National Road Network data (NWB)	free
Alterra	Data on land use, attractivity and landscape are overlaid by Alterra to produce attributes per link of the network. Updated every year.	For a consultancy fee, roughly 1000 Euro per year per province
KNMI	Rainfall prediction data	Currently free in ROADIDEA project. Dutch Bicyclist Union needs to negotiate a special price for this service with KNMI
Topographical Survey Department	The Top10 1:10.000 scale topographical map of the Netherlands is used a background map on which the bicycle path & roads are drawn.	The license to use the Top 10 vector data costs about 1000 Euro per year per province. It should be noted that this can be replaced by the free Google maps as a background.

The above-mentioned data sources are all sustainable in the sense that they are provided on regular basis and will continue to be provided in the foresee-able future. It should also be noted that majority of the data and the data quality checks are done by the volunteers. As long as the Dutch Bicyclist Union mobiles and stimulates the volunteers this can continue.

3.3.5 Service Network description

Dutch Bicyclist Union DBU Service Network

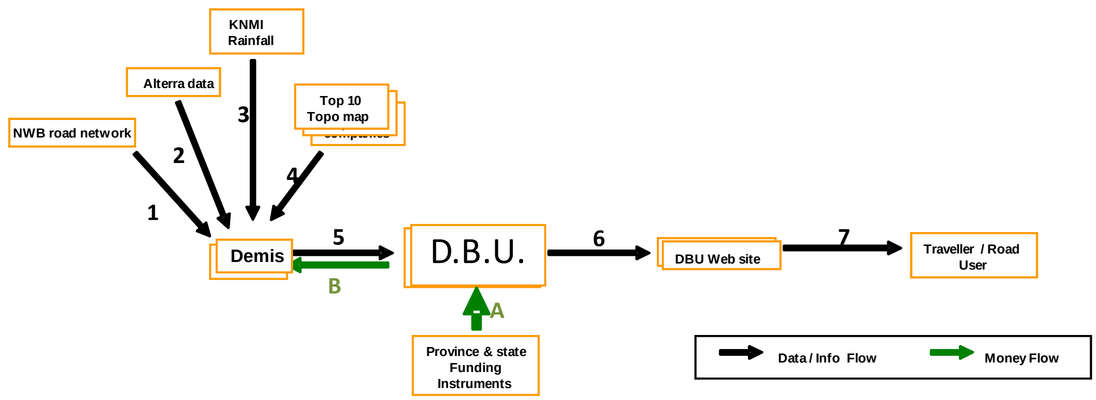

Figure 3.4. Description of flows in the figure:

Table3.4. Principal data and information flows.

Data & Information Flows	
Number	**Description**
1	Road network data provide by the ministry of Public Works
2	Alterra data provide network link attributes for land-use, attractivity and landscape.
3	KNMI provides real-time rainfall data and rainfall predictions
4	A topographic background map is provided by the Topographic Survey Department
5	Demis processes all delivered data in an operational planner
6	DBU does quality checks and provides volunteer input to enhance the data. The end results is published on a web site
7	The users can use this service for free

Table 3.5. Principal money flows.

Money flows	
Letter	**Description**
A	Provincial authorities is the mainstay of the planner. Some funding by Senter-Novem for innovative research has been secured in the past.
B	For data processing, software development and maintenance Demis is paid a consultancy fee

Table 3.6. Different actors and their main roles.

Actor	Description of role
Provincial authorities	Provide funding to achieve their objectives in terms of sustainable transport and “must have” public services
Senter-Novem	Provides funding for innovative developments
Dutch Bicyclist Union	Owner and organiser of the bicycle route planner service
Alterra	Provides data on consultancy fee
Ministry of Public Works	Provides free road network data (NWB)

KNMI	Provides rainfall prediction data
Topograhic Survey department	Provides background topographical map
Demis	Software support and development
Volunteers	Enhance underlying data and data quality of the service
Users	Use the website to obtain trip planning with rainfall prediction, for free.

3.3.6 Other: potential links to other services

Once the service covers the whole of the Netherlands it will be attractive for other provides such as multimodal route planners (e.g. www.ov9292.nl), for policy analysis on bicycle transport by public authorities, campaigns to the stimulate bicycle transport as an alternative for motorised transport. And probably the TomTom and other route planning device providers may start to offer higher quality non-motorised route planning services. Even Google might be interested now that they have started the initiative for free route planning on the internet.

The Dutch Bicyclist Union have always held the position that they can control the market through ownership of the network data. As these network data have a much higher quality than other networks, that is an interesting strategy. If this strategy will work in the long run remains to be seen.

3.4 Fog Warning System – “theoretical” pilot

3.4.1 The objective of the service

Different unfavourable weather conditions, such as fog among others, result as real disturbance and negatively influence to road traffic. It is reasonable to build a continuously operating, monitoring and warning system, which collects different information on traffic and weather. These systems represent the presently available state of the art and are suitable for providing critical information and for alarming and warning, if necessary. However, the installation of a system, which addresses only fog among the several adverse conditions (Fog Theoretical Pilot), shall also be considered. The above-mentioned pilot – according to the proposal – is designed to support the managing of the traffic disturbances resulting from fog, a frequent phenomenon in the Po valley. In our opinion such a system should be a part of a bigger, general meteorological warning system.

The main goal of the pilot is to set up a system which allows possibly large end users groups to access visibility information in real time as an important element for their travel planning or on-route decision making process. This process can lead to pursue several options:

• Change of route in view of thick fog. For professional end users this can mean taking a detour but saving travel time and lowering the risk to incur in an accident.

• Break the trip until visibility conditions improve. For professional truck drivers who are subject to systematic rests this could optimize their planning.

• Privates could decide to modify the route, take the train instead of the car, or simply postpone the trip.

3.4.2 The main information contents

Real time visibility information and alerts via internet/ mobile phones.

Fog reduces visibility on the roads. The effective visibility is quantified by means of a device called “visibilimeter”; this is the primarily required step. The basic strategy lies in the creation of a visibility map representing the real visibility conditions, and hence of an informative system that may provide information and possibly warning on different levels and alarming, if required, on all routes. The ARPAV implementation relies on data collected from a network of 10 visibilimeters, which were installed for the FTP on an area of roughly 10’000km^2, surface temperature and wind measurement data as well as information from satellite. The FTP focuses on the visibility conditions and can be considered as a complement to the more generic weather information delivered by various channels. It is, however, beyond the scope of the project to integrate the FTP with traffic models, or link it systematically with accident data.

The following data sources will be the basis for the construction of fog monitoring products:

- Data from the surface visibilimeters network
- Satellite imagery (MSG).
- Data from the meteorological network of ARPAV (temperature, humidity, solar radiation and other sensors).

Different products will be generated, showing the different data sources outputs. These outputs will show the data separately or in a combined way (for example satellite map together with visibility data at the ground), but only some of them will be made available for the users.

The main product for users will be a fog probability map, showing the probability of fog and of dense fog on an area, represented by means of three or four classes (high or low probability, etc.).

Virtually, the fog pilot will take advantage from information of quite different origin, such as satellite, direct visibility measurements (visibilimeters), standard meteorological measurements, but also visibility estimates from web cams, visibility reports from traffic participants and other observers. This ‘open’ architecture of the visibility model enables, in principle, inclusion of data sources which may become available **in the future**. The most relevant ones, we are aware of, are consistent with the Roadidea data platform concept and include:

• Vehicle CAN-BUS data concerning fog lights being used (indicator of low visibility conditions);

• Car manufacturers which start mounting visibility sensors on high-end cars; if such data would become available they would dramatically improve the spatial distribution of this information, especially where it is useful;

• Based on a visibility-velocity relationship even information on traffic speed may be included as worthwhile information which can help to decide whether low visibility conditions are present.

These truly mobile data sources will be accessible and exploitable in near real time only after the data transmission and organization challenge will be solved. It is thus unlikely that it will be effectively implemented in the fog pilot within the lifetime of Roadidea.

3.4.3 Potential users of the information

Professional truck drivers, private drivers, road management companies, local authorities.

Information on reduced visibility distance caused by fog is mainly exploited by road users which may be differentiated into three groups:

a. Road users, who plan to use the road (in the future). These users require *information* on the expectable weather and traffic situation on different defined routes in the future, (more exactly, if there is fog and if yes, how heavy it is at the time they plan their travel for). These data are required for travel planning and modifying the originally selected route.

b. Road users, who are on the road and near to a reduced visibility (foggy) road section, require *warning* in order to make preparations for travelling through the foggy section. For this they need instant data, visibility map real time information.

c. Road users, who are travelling on foggy stretches, require *instructions* depending on the data and *warning* if required. For this, instant data are required.

Information about fog is also used by road managers. In case of a central traffic monitoring and controlling system, the road manager shall be exactly aware of the traffic volume, speed, compound at each point of the managed road network and the weather conditions which influence traffic flow and may lead to danger. It is obvious that the reduction of visibility (developing fog) means significant danger; therefore the on-line visibility map in the planned FTP is a very important tool for situation evaluation. Traffic controller needs short-term forecasting data as well, in order to prepare for the disturbances caused by the fog. What does the road manager use the FTP information for:

a. Uses information for the purpose of road traffic control. He/she may display such information and instructions on the appropriate road signs and portals which influence the road users' behaviour travelling in the fog. These instructions may be different, for example we know such fog warning system where road sections are closed when the value of the visibility distance fall below a certain limit. Instructions are usually used for selecting speed and keeping the safety distance. (headway). The basis is that the road users shall pay higher attention and keep all traffic rules.

b. Warns the police on change in the visibility and provides detailed information on exact places where disturbance (incidents or accidents) may occur.

c. Warns the ambulance and provides information where rescue, re-grouping rescue sources, and extra duty are required.

On the end user layer a number of distinctions can be made, in that they can be private, professional, and institutional, and they can be at home or in the office planning a trip, or being on the road having to take decisions concerning the route. If they have, in the planning stages, access to the internet this would be the most natural and comprehensive option. If on the road, the MMS/WAP option could be an alternative to access visibility information needed to make a decision.
Road management companies could be very interested in fog monitoring products.
On the 2nd of july 2009 a "1st Users Meeting" was held at ARPAV – Centro Meteorologico di Teolo. Different users potentially interested in the fog pilot were invited to the meeting. There were 15 participants, representing 11 different users – mainly road or highways management companies, public local authorities with road maintenance responsibility and railway company. A questionnaire was distributed and compiled.
Most of the participants were really interested in the pilot and in the fog products.
Other potential users of the information could be media, in order to broadcast real time information about fog probability in the region.

3.4.4 Benefit / value for users or other stakeholders

For users: saving time, increasing safety.
For society: increasing safety.

- Direct benefit, economical or comfort, to the individual traffic participant, who can account for low visibility conditions and decide to go slower, take alternative means (e.g. train) or alternative route, or postpone the trip; traffic flow and accident risk will be reduced;
- Economical benefit for professional users that are able to take advantage of low visibility information in their planning process, which includes minimizing the part of their fleet in traffic congestion due to traffic slow down or accidents;
- Social benefits as raised awareness can lower accident risks;
- Coupling of visibility model with a traffic model, e.g. to include low visibility conditions in travel time estimation; this would be, to our knowledge, a novel element in traffic modelling and would necessitate a quantitative relation between visibility and traffic flow; ARPAV does not intend to exploit this, but does nevertheless highlight the potential;
- A traffic flow model which takes visibility into account would facilitate an assessment of the additional time of permanence in the traffic and help the monetization of the costs incurred due to the delays; for such an analysis it would be necessary to know the user-specific delay costs.

3.4.5 Information providers

A variety of visibility information will be processed and combined with satellite observations. As visibility measurements are not standard meteorological quantities in the sense that they are not routinely measured by automatic weather stations, ARPAV has installed a network of 10 visibilimeters, in the framework of ROADIDEA project.
Arpav is the owner and manager of the regional meteorological stations network and visibilimeters network.
Satellite data are provided by Eumetsat, thanks to an agreement which involves also Italian "Aeronautica Militare" meteorological service.
Particular software is needed to derive specific information about cloudiness (clouds classification) from satellite data. This software, called "Nowcasting SAF", is a scientific non-commercial software developed in the last 13 years by a consortium involving many different organizations, and was installed on ARPAV computers where it now runs routinely.

The process of data merging/combination to derive information about fog and to generate specific monitoring products is performed by ARPAV by means of procedures and software, which were developed during the projects and run on the computer facilities available in ARPAV.
The information about fog will be provided via Internet web site and a WAP (web) site, in order to be accessible also by users on the road with a mobile phone.
ARPAV will create specific web pages to show the fog products, and will test a trial WAP site with selected users

3.4.6 Other service providers

If WAP proves to be significant distribution channel for the fog warning products, a professional WAP provider would be necessary.

3.4.7 Financing

The principle is that who take advantage from the information should pay for it. The owner of the vehicle on the road contributes to traffic costs in several ways, mainly via taxes (fuel, weight, registration etc.) and road fees. Thus it is obvious that the budget establishes and maintains such systems (e.g. FTP) for the charge of this revenue which ensures road traffic safety, comfort and cost efficient operation. FTP serves mainly, but not exclusively, the road traffic safety, so it seems to be obvious that the „*cost per vehicle*" or part of such systems is built in the fee of vehicle liability insurance. Vehicle insurance companies are not included in the business model listed in the APPENDIX of „D7.1 Transport information service business" as cost resources, but this opportunity should be exploited.
Motorway users should pay FTP services and information separately. One part of motorway fee (vignette) should be used for contribution to the operating FTP system costs.
Source of FTP costs:

- Vehicle tax
- Fuel tax
- Vehicle liability insurance
- Motorway fee

In principle any user of the service could pay for it. If we consider a single final end user, he could take out a subscription to access the web site or the wap site with the fog products.
The most interested users should be, anyway, road or highways management companies: they could pay an annual subscription to use the fog products. The results of a preliminary survey (see 2.1 "1st End User Meeting") shows that they are prepared to pay, if the quality of the product is good.
Media could also be interested in the products, but, as far as we know, they are not willing to pay.
Another possibility to finance the service is to have public financing from some regional authority, e.g. Regional Civil Protection, which could be interested in the improvement of traffic safety.

3.4.8 Proposed innovation in FTP.

FTP collects different weather, traffic and accident data and creates short-term forecast using the three built-in models further to instant data. **Forecast of accident situation** means innovation which may forward the preparation for police and ambulance works, appropriate allocation of available resources.

- Short-term weather forecast (fog development) model
- Road traffic short-term forecast model
- Accident forecasting by short-term model

FTP provides further information for the users.

- o Changes in accident risk due to the fog. (Information for modifying the on-going travel and facilitating route planning. If the road user feels that the traffic represents unacceptable risk in the given circumstances, the original plan can be modified.)
- o Changes in the Level of Service (LOS, in traffic engineering) due to the fog. (Information for modifying the on-going travel, and estimating the expected arrival time)

These may be instant values as well as short-term forecasted data. Instant values can be used mainly by road traffic control, but may be useful for participants of professional heavy vehicle traffic, bus traffic. Estimates for future can be used mainly for route planners (Transportation companies, business travellers etc.), but conscious private travellers may also consider this information. It is reasonable to require separate fee for this information (usually in the frame of mobile telephone and internet service.)

3.4.9 Comments

The FOG WARNING SYSTEM, as it is illustrated in the system description, provides easily understandable information on current and future formation of fog, its occurrence and density on a given road network. This information, either current or refers to future situation, may be useful for road users, that is to say, this information has value. The task is to pass these information to those potential users, who are willing to pay the price of them. One of the questions is the reliability, accuracy and applicability of the data ensured by the available technical equipments and modern softwares. The other question is how to distribute these information quickly and cost-effectively to a wider range of users.

Regarding FOG WARNING SYSTEM there are two ways to share information, the passive and the active process.

According to the *passive method* the continually updated data are available – in an accessible way – in an adequately concentrated and easily comprehensible way. The user has to „go” for the information and „download” it for itself or take it over.

As per the innovatory idea that has come up within the framework of ROADIDEA, a so called *immediate active method* can be applied in the future. The essence of the method is that the „FOG WARNING SYSTEM” knows all the information relating to the fog, and it is able to determine which are the road sectors where road users have to be warned or advised (perhaps instructed), and it notifies directly these, and only these, travellers (almost immediately). There is a possibility to send the message directly to mobile phones, since the system automatically identifies the mobile phone positions of those travellers that might theoretically need the information about the fog on the spot. Technical details are yet to be determined, for the time being this is just an idea. There is a possibility for immediate but indirect active data forwarding, for instance, through the system that controls the urban bus traffic or via the taxi-centre. Of course, in such cases data are not forwarded to mobile phones but the usual electronic data transfer modes are being used.

Non-immediate active method is when the central system sends future , not current, information for those users, who subscribed for this service and might need these data in the near future (1-3 hours) or in the not too far future (1-3 days).

Such users might be either public transport companies, taxi companies, forwarders, regularly travelling private drivers, who are participating in urban transportation, or organizations operating vehicles in long-distance (international) transportation. (Trucking companies)

3.5 Hamburg Port – Theoretical Pilot

3.5.1 Objective of the service

The purpose of the pilot is providing a prediction tool for the generation and distribution of an overview of the road traffic situation depending on the ship arrivals and departures. The problem consists of two parts:

• the determination of a correlation between ship arrivals and road traffic generated by the container terminals

• the distribution of the generated road traffic situation on the road network.

There are two levels of pilot development. A first and slightly simpler problem is to provide a model merely for traffic planning. This model would then predict the road HGV traffic volumes based on planned ship arrivals/ departures and based on statistical data on road traffic. This approach would support road traffic planning purposes.

The second and even more complex problem would be to make the process dynamic based in real ship arrivals and the online traffic situation based on measured road traffic data. This approach would more support traffic management purposes.

3.5.2 The main information contents

Traffic volumes in general in the Port

- Lorry volumes on the road network
- Ship arrivals and departures
- Container Handling Times
- Container Throughput of a Terminal
- Number of containers delivered
- Number of containers sent

3.5.3 Potential users of the information

Port authorities, authorities responsible for road traffic management. Transport companies, traffic information service providers

The Hamburg Port Authority (HPA) is responsible for planning und operating the road network in the port area. This means, HPA is responsible for the road construction and the traffic planning for all roads in the port area. It is in HPA`s interest to keep the traffic on the roads fluent and to provide access to the container terminals and all other port facilities.
For the future, HPA considers a complete re-organisation of the container hinterland transport on the roads, introducing an inland hub. For the justification and planning of these measures, it would be helpful to model the generation of container flows.
HPA does yearly traffic counts and has a statistical overview of the general development

3.5.4 Benefit / value of the service for users or other stakeholders

The availability of predictions would allow road traffic planners to design the transport infrastructure according to the future demand, to consider alternative transport modes and schemes or to plan more intelligent technologies for traffic control and traffic information. The availability of online predictions of the impact of maritime transport may lead to planned short-term traffic management measures in order to be able to handle peaks in road freight transport.

The Hamburg Port Authority is currently planning the establishment of a port-related traffic management system. Part of this system will be a road traffic model for the port which is now built up step by step. An important feature of this model should be a prediction of road freight traffic depending on the maritime transport activity.

3.5.5 Information providers

Currently there are two identified suitable data sources:

- DAKOSY Datenkommunikationssystem AG is the transport information service provider for the Port of Hamburg. The company operates a number of applications (SHIPS, TRUCKSTATION, ZAPP) which contain interesting data sets about:
  - all planned ship arrival and departure times,
  - all container numbers of arriving and departing containers on board the ship together with the ship and the destination and transhipment terminal,
  - historical data about container truck movement at terminals
- The HPA is the owner of the information about ship arrivals, departure times and the number of containers on a ship and send it automatically to DAKOSY.
- The database of HPA contains historical traffic counts on all important road network parts.
- The HPA maintains a model for container traffic including ship moves, berth times and amounts of cargo to be loaded and unloaded, including simulations of ship moves.

- The container terminals own information on container handling times and truck moves.

For the implementation of the service it is necessary that information can be obtained from the following additional stakeholders:

- Customs and other organisations of the German administration
- Packing Stations
- Hauliers

3.5.6 Other service providers

The service can be operated by HPA itself.

If a viable business cause can be identified DAKOSY, the Hamburg port information service provider might be interested in operating the service.

3.5.7 Financing

Currently only the HPA would pay for the service. So the sources would be public financing. It is unlikely that end user on the road would pay for the service, because there is no market for traffic information which could be generated by the service. The only sponsor for the service could be an association of hauliers, which wants to get their goods faster to the ships.

The tax payer would pay for the service because the Port of Hamburg is a main factor in the regional development. Making the Port more efficient is a primary goal of the municipality. It is, however, interesting to obtain private contributions.

3.6 *Residual salt detection system- service* pilot

3.6.1 The objective of the service

In winter season after each salting action, a certain amount of salt remains on the road surface till the next spreading. Determination of residual salt on the road is of high importance for optimization of salt consumption. Contemporary methods for determination of residual salt on the road are based on conductivity measurements of brine. This approach has many disadvantages and enables point vise detection only. We have developed a measuring system for remote detection of residual salt on the road. The measuring system enables static observation of critical spots or measurements in motion. The method is based on measurement of fluorescence signal emitted from a flourescent tracer. This approach enables fast, non-contact, weather independent, continuous detection of concentration and distribution of salt on the road as well as monitoring of salt migration into the environment. The prototype detection systems has been tested on predefined local road sections in Slovenia in winter 2007/2008. Further research and development is in progress.

Residual salt detection system enables permanent detection of salt left on the road after spreading action. The data gathered directly from the road are of high importance for operators and indirectly for road users regarding planning of subsequent actions and getting right information about the safety state of the road, respectively.

3.6.2 The main information contents

Information for operators: 2-D residual salt concentration profile on the road surface (g/m^2).
Information for road users: safe road surface conditions – unsafe road surface conditions (danger of black ice or slippery road)

3.6.3 Potential users of the information

Road operators.
Road users.

3.6.4 Benefit / value of the service for users or other stakeholders

Operators: reduction of salt consumption, energy savings, personal savings, etc...
Road users: higher safety

3.6.5 Information providers

Road operators, road surveillance service, private company, police, ... / measurements by patrol cars, static measuring equipment for permanent surveillance of critical spots.

3.6.6 Other service providers

In principle no. However, Implicit information about road safety conditions can be transmitted by other service provides as radio, internet, navigation, TMC, etc...

3.6.7 Financing

1. Public financing - road administration – road operators.
2. Possible co-funding by private sector developing tools for road management and navigation.

4. Roadidea ideas and business models

4.1 Ideas from the first Innovation Seminar

Tables 4.1-2 summarize the ideas from the first Innovation seminar in 2008. For each idea the exploitability, business opportunities and primary and secondary customers are reviewed. Part of the ideas have developed also to ROADIDEA pilots which were described more in the preceding chapter.

Table 4.1. Collection of ideas from the first innovation seminar

IDEAS	**Cross-border weather alerts, location based systems**	**Mobile phones as sensors, mobile sensor data acquisition**	**MyRoute mobile pocket guide, route selection information while planning**	**MyTravel Toilet Tom-tom, updating info while travelling**	**In-vehicle information on speed, traffic and road condition**	**EUROADMAP weather databases; sponsor-based business model**
state of the art	Setting the cooperation with national meteorological institutes	Nokia's mobile millennium most famous case (more info *) also existing systems in many places in Europe	Elaboration of the vital elements for realisation	Elaboration of the vital elements for realisation	Existing services (navigators as old and mobile phones as new media)	Idea new, First trial with FCD made in Track&Trade, All technologies available
vision	Localized on trip alerts about difficult weather conditions	Pre and on-trip traffic information service	Customized pre and on-trip travel/traffic information service	Customized on trip information service	On-trip driver supporting systems / information	Provision of different level aggregated weather data for tailor-made purposes, Weather content provision for third party service providers
obstacles, legal problems	Data quality differs in different countries	Privacy issues (customer must sign an agreement to be with the service)	Collecting data from vehicle sensors and sending to Central database could have some legal problems	Database, Roadmap, Subscription model	Legal issues drive for safe use of different media	Unknown weather data availability in Europe, Unknown charges and license fees, Format differences
data avail-ability	Data exist, but local accuracy (forecast area) differs	Existing systems	Raw known data can't be used directly – data fusion or integration is necessary as well as value adding aggregation	Categorisation by position, purpose, size, working time	Data has variable accuracy in different areas (best info on main roads, town areas most difficult to cover)	Partly known and good, partly bad or completely unknown
exploit-ability	For private and	For private and	Transport field, urban planning,	Mostly for private	For private and HGV	Good: Availability of weather content

	professional users	professional users (traffic management)	economics, policymakers, consultants dealing with mobility issues, authorities dealing with traffic flow, traffic information to (local) governments.	users	drivers	without own know-how and data
business oppor-tunities	One important data feed (value depends on accuracy / localisation)	One new form of traffic raw data to be used in different services	Private sector and businesses	As a part of some other Tom-Tom services	As part of other services	Unknown, to be investigated by survey
primary target customers	For private car and HGV drivers	For private and professional users (traffic management)	Mobile companies, authorities		For private and HGV drivers	ITS-service providers, road authorities, fleet dispatcher, content providers, newspaper
secondary target customers			Private users	Private users		Everybody who is interested in weather (nowcast & forecast) as supplementary data for own applications

Table 4.2. Further ideas from the first Innovation seminar

IDEAS	PULP FRICTION friction models; rwis & weather & maintenance	EYEAR Road eye; friction data collection & transmission	Traffic forecast models	PORT port-related traffic modelling see PORT pilot	FREEDATA A free geospatial and weather data	RTFM better & tailored user interfaces; regard personal needs	STAYHOME effects of staying home instead of travelling
State of the art	To make better estimation of the prevailing and forecasted road weather	Driver assistance systems and on-board equipment for cars exists. It is also possible to send collected data to a central server via digital radio communication. Floating-car data detection is resolved as a technical solution, C2C communication is subject of current research	Non-parametric forecasting program developed	There is information about the container ship movement in the port. - It is known how many containers are brought and picked up by container vessels. Also the container destinations/ origins in the hinterland are known. There are also figures about road traffic on the access roads to/from	Same as a year ago, though the situation of road weather station data is worse than expected	Report on innovation Wiki, several ongoing studies in FP7 projects	Report on innovation Wiki, several ongoing studies in FP7 projects

				the port.			
Vision	To predict friction	The idea is to collect data about friction by measurements in the car and to transfer it to a centre in order to enable a service to road users which warns of black ice and slippery roads. The car is used as a probe. Several equipped cars enable the service. A central server processes collected friction data. A map display is generated. Warning messages to other vehicles are generated and distributed by radio. The method could be enhanced by communication between vehicles.	To install the internet and phones flow forecasting model	A model is required which predicts the incoming and outgoing container trucks at a terminal gate in a certain time span depending on the knowledge on the pattern of the container ship arrivals / departures.	Very slow improvement unless strong intervention from the Commission	Interfaces accessible for more people	Traffic congestions reduced, pollution reduced, more efficient use of time
Obstacles, legal problems	The quality of the forecasted friction is unclear	To equip enough vehicles, to access to CAN-bus of different vehicle types, to create and sell respective on-board units, to track car and keep privacy, to enable maintenance of the system, to find a service provider and a business model, service more relevant and requested in the northern countries	No	Data is available in the hands of private service providers who might want give it only against payments, private service providers might want to negotiate if other service platforms/ providers come into the game, container transport data is private and confidential	National legislation, heterogeneity of data sources	Different protocol, different logistics, no coherent regulations	Logical problems, not many industries available
Data avail-ability	RWIS data available (hosted by Finnish Road Administration). Also, FMI's road weather model data available.	Data must be generated by special floating cars, respective sensors need to be installed.	Depending on the country	The procurement and assessment of data needs time. It cannot yet be determined whether the available data is useful and whether other data is needed	Same as year ago	Varied sources, difficult to compare	Projections difficult to verify, no testable sources available to this study
Exploit-ability	To make better estimation of the prevailing	Service useful as a complement to available traffic information services	Public, private companies and agencies	A process model is needed asap which determines the	Suffers from data problems	Mass market potential, highly possible	Limited exploitability prospects

	and forecasted road weather			interdependencies in the transport of containers		if new products innovated	
Business opportunities	Not actual business product. Mainly aimed for the public sector (at first). Later possible to create products for drivers.	An option for private service providers to include additional content	Servicing of the model will be a part of business	Only a concept is possible	Limited in Europe due to poor data access	Growing industry development driven new innovations constantly on the market, (Nokia, Siemens etc.)	For software companies, teleoperators
Primary target customers	Meteorologists and road maintenance personnel at first. Later probably products for drivers, too.	Car drivers	Public users, transportation companies governmental agencies	Port authorities, authorities responsible for road traffic management	All transport users and professionals	End users (elderly people, disabled, foreigners	General public, ITC workers
Secondary target customers	-	Traffic information service providers, Traffic managers	-	Transport companies, traffic information service providers	Operators (tele, web etc.)	Tele-operators, software development companies, phone rental companies	Community officials

4.2 Ideas from the second innovation seminar & business models

Table 4.3 presents the ideas from the second innovation seminar [RI D6.4 2009]. For each idea potential users and business model are reviewed.

Table 4.3. Ideas from the second innovation seminar

Idea	Users	Potential Business model	Comments
Semi-public transport - advanced private public transport services	People needing to move from one place to another + companies offering taxi , car-pooling etc. services.	Government funding or tax reduction + end users payments according to service level.	The service uses several information services, potentially consolidated with transport services. The feasibility and sustainability of this service concept is high. It is likely that such services merge.
DYNAMOBI - Cooperative dynamic navigation, multimodal and scalable –“ Ubi-travel”	People moving in all transport modes.	Ubi-travel system needs very large, reliable and complicated infrastructure and thus it is very likely that some public funding is deeded for its maintenance. Several end-user services will be provided by service companies competing on the market based on service level and pricing.	The service includes several embedded services.
No-man driving - Autonomous driving - “eJameson”	People needing to move from one place to another; both for public and private travel modes.	End-user payments for according to the service level. Car manufacturers may be sponsoring some services. High speed solutions require good PPPs. Entertainment services may be sponsored by any other industry (e.g. “eJameson”) or run by advertising payment model.	
Waste to energy	Drivers	End users are paying their energy usage; taxation could be used	The service may have different forms, for

		to promote the use of bio-waste and bio-energy.	example “mobile service stations”, or local bio-energy production.
Travelling on offices - working on transport - teleworking	Office workers.	The companies employing the users will be paying the services. There may be advertisement and other models included. Tax reduction may be used as a carrot to reduce travel.	The concept of working should be enhanced to reduce the need for transport in general.
Lego-block transport - Intelligent modular structures - modular cars parts and super light weight vehicle- modular car trains	Private drivers.	User pays the services.	The concept fits to all previous idea sections, and can be combined to those. However, this idea may not have enough savings inherent to become a feasible new transport concept.

5 Business model developments outside ROADIDEA

5.1 Internet commerce business models

Table 5.1 below describes a variety of business models of Internet commerce as described by Rappa [2009]. Their applicability to transport information services is analysed in the third column. It can be concluded that most of the business model types could be applied also for transport information. The main challenge for those based on end user payments is to make the customers willing to pay for the transport information services.

Table 5.1. Business models of internet commerce [Rappa 2009] and applicability to Transport Information Services.

Business model for Internet commerce	Description	Applicability for Transport Information Services
Brokerage	Brokers bring buyers and sellers together and facilitate transactions. Usually brokers charge a fee or commission for each transaction it enables.	Possible also in transport IS if the end users are willing to pay for the services. Brokers may operate as integrators of different types of information or of services and information. Willingness to pay may be higher if “real” services are delivered together with the information.
Subscription Model	Users are charged a periodic -- daily, monthly or annual -- fee to subscribe to a service. It is not uncommon for sites to combine free content with "premium" (i.e., subscriber- or member-only) content. Subscription fees are incurred irrespective of actual usage rates. Subscription and advertising models are frequently combined.	Subscription is currently used for premium navigation services. Sustainability is not yet known. Subscription and advertising can be combined in some cases.
Utility Model	The utility or "on-demand" model is based on metering usage, or a "pay as you go" approach. Unlike subscriber services, metered services are based on actual usage rates. Traditionally, metering has been used for essential services (e.g., electricity water, long-distance telephone services).	The payments would be dependent on the usage of the information – requires that the users are willing to pay.
Manufacturer (of product or service)	Dealing within the web allows manufacturers to reach buyers directly. The model can be based on efficiency, improved customer service, and a better understanding of customer preferences. (e.g. Dell Computers)	N.A.
Merchant Model	Wholesalers and retailers selling on list prices or through auctions. Virtual Merchant: seller only acting through web Catalogue Merchant: mail-order business with a web-based catalogue Click and Mortar: traditional brick-and-mortar retail establishment with web storefront. Bit Vendor: a merchant that deals strictly in digital products and services and, in its purest form, conducts both sales and distribution over the web (e.g. Apple iTunes Music Store)	Bit vendor approach for information; both through web and other channels. Requires the willingness to pay.
Advertising	The advertising model works best when the volume of viewer traffic is large or highly specialized.	Transport Information services which are able to attract high volumes of

	Portals offer content or services and advertising space for banners or paid editorial content (e.g. yahoo!) Classifieds – listed (sometimes paid) content (e.g. monster.com) User registration – sites offering content but requires registration of the user. Personalized Information is used for targeted advertising campaigns. Query-based paid placement sells favourable link positioning or advertising keyed to particular search terms in a user query. (e.g. Overture: pay-for-performance) Contextual Advertising / Behavioural Marketing: targeted advertising based on an individual user's surfing or content targeted ads like google offers. Intromercials: animated full-screen ads placed at the entry of a site before a user reaches its intended content.	viewers could benefit of advertising. Requires attractive interface. Targeted advertising (specialized viewers) based on location is possible. Intromercials not good method for services used often.
Infomediary Model	Some firms collect valuable and carefully analyzed user information as well as information about producers and their products and bring them together. E.g. with Incentive Marketing they can augment the users loyalty, for instance using redeemable points or coupons for making purchases from associated retailers. Data collected about users is sold for targeted advertising (e.g. happy digits, payback)	Is data about users of transport information services valuable for some party? For travelling services?
Affiliate Model	In contrast to the generalized portal, which seeks to drive a high volume of traffic to one site, the affiliate model provides purchase opportunities wherever people may be surfing. It does this by offering financial incentives (in the form of a percentage of revenue) to affiliated partner sites. The affiliates provide purchase-point click-through to the merchant. It is a pay-for-performance model -- if an affiliate does not generate sales, it represents no cost to the merchant. (amazon.com) Banner Exchange -- trades banner placement among a network of affiliated sites. Pay-per-click -- site that pays affiliates for a user click-through. Revenue Sharing -- offers a percent-of-sale commission based on a user click-through in which the user subsequently purchases a product.	A possible model between Transport Information Portal and Transport Services?
Community Model	The viability of the community model is based on user loyalty. Users have a	How to create social networking around transport

	high investment in both time and emotion. Revenue can be based on the sale of ancillary products and services or voluntary contributions; or revenue may be tied to contextual advertising and subscriptions for premium services. The Internet is inherently suited to community business models and today this is one of the more fertile areas of development, as seen in rise of social networking.	information? Linking transport information to social communities, like FaceBook or Twitter?

5. 2 Business models of i-Travel services

A European project i-Travel [i-Travel 2008] aims to develop European wide travel information services by integrating different service providers, service operators and content providers into a network. The idea is that no partner in the network can cover the whole spectrum of content providing or service operating but that it could be done in cooperation. i-Travel considers both travelling and travel information services.

In a deliverable D1.1 [i-Travel 2008] business models of travel information services are discussed, based on the current state of the art. The business models are viewed from two different viewpoints with the following conclusions:

For the **Service Provider versus Content Provider** viewpoint four models are identified:
Non Commercial Model – The services provided by the Service Provider are either internal, generated by the Service Provider or are obtained from non-commercial partners like for instance other governmental instances.
Content Centric Business Model – Content providers make data available to Service Providers and get paid for the content. In this case the Service Provider may promote a specific service but includes third party content to attract possible customers to this service. This for instance could be an airline operator offering a journey planner which includes the services of a traffic information provider.
Service Centre Centric Business Model – Service Centres offer the information obtained from Content Centres to the end-user as a service to the Content Providers. Service Centres are paid directly by the Content Provider or get the Content for free in exchange of advertising space.
Mixed Models – In reality pure Content Centric or Service Centric business may not exist. In i-Travel [2009] it is concluded that a mix of the two models will probably make more sense to drive a commercial viable i-Travel system. Some of the Content Centres will get paid for the services while other Content Centres will need to pay the Service Centre in order to make their services known to the public.

For the **End-User versus Service Provider Viewpoint** three models are possible:
Free-To-Use Business Model – As part of the service to the public, a public authority offers a free service to the public. The system is paid mainly by means of taxpayers' money. Web portals adhering to this model may include information from other governmental transport providers.

Paid Business Model – In this case the end-user pays for the services provided. This is for instance the case when using commercial services such as parking space ordering via SMS or querying traffic information via a commercial Interactive Voice Response (IVR) system.
Mixed Model – A basic service may be offered free-to-use but more advanced services need to be paid for.

As a conclusion, in i-Travel it is considered likely that the services will be delivered by a combination of the private sector and the public sector. Both private as well as public organisations are needed to build up a comprehensive value chain, reaching from various content providers to regional and international service providers [i-Travel 2008].

Moreover, a competition between private and public is expected to stimulate new services but it is considered important to reach a critical mass for economic reasons. Too many services make the end user insecure and can block the launch of services. It seems that a mix of public – to trust in the quality of the service – and private – to meet the requirements of the market with innovative services – can optimize the start period [i-Travel 2008].

5.3 Services for a connected traveller and linking to social media

Connected traveller services are a personalised form of Intelligent Transport Systems, to reduce the impact of congestion [Korz & Stroek 2009]. A connected traveller uses the services while travelling; for example in public transport. The services will be available everywhere, enabled by ICT being everywhere.

Korz & Stroek [2009] have analysed the potential business models for these services. They have come to the conclusion that the key to success is to combine the services with other services, like social media (FaceBook, LinkedIn, dating services etc). This is because financing with advertisements requires a large user base, which is difficult to achieve just with solitary traveller services. Also, in case of subscription services, the traveller services may give additional value to the user but the extra cost of a connected traveller service would be relatively small. The travelling users are not ready to pay for as much as building a distinct traveller service would cost.

5.4 Applicability of Value-based business models

In case the end users pay for the services, there are four basic types of pricing [Kettunen et al.2008]:
- cost-based pricing: price = production costs + profit margin,
- market-based pricing: prices of corresponding services in the market are the starting point,
- brand-based pricing: the brand value may increase the price higher than the market price of similar non-branded services,
- value-based pricing: price is based on the value received by the customer.

The last one is an example of performance based business models which have been developed in other service fields, like construction [Karvonen et al. 2008]. In performance –based business models the end product to the customer is not the physical object, information or service activities as such but the value and performance given by the information or services. One example is providing services for saving energy in buildings. Here the performance- / value-based business model means that the service provider earning is based on the realized savings of energy. Typically the service provider and the client share the savings.

The implementation of a value-based business model is challenging. The pricing and customer payments should be bound to the value customer receives. Thus it requires that it is possible to measure the customer value indisputably. How could this be applied for transport information services?

Savings in cost and time, convenience and increase of safety are typical values a private end user can achieve when using transport information services. How to measure the value? As an example we can consider saving of time: In value-based business model the end user payment would be dependent on time savings. If for a specific use case the transport information does not help in saving time, it is given free. Instead, if a lot of time is saved, the user pays more about the service. But: how to measure the used time and decide if time has been saved or not? How to decide the level with which to compare? The traffic situation might influence to what should be the "normal" time for comparison. Or how to take into account that the actions of the user may affect to the time saved (for example not following given guidance)?

Thus an earning logic basing the payments on achieved customer value includes risks for the service provider and seems to be quite difficult in general; also for information services. The utility-based business model presented in Table 5.1, based on how much the service / information is used is easier to implement if subscription model (periodic charging) is not applicable.

6. Lessons learnt from ROADIDEA pilots

6.1 Service value and financing

The service value can be estimated from three main perspectives: individual, commercial and societal. From individual perspective saving time, increasing safety and enjoying more convenient journey can be those attributes. From societal perspective the attributes fall into socio-economical feasibility.

Financing models which could be applied to the actual pilot, in this case pulp friction, can be divided into two main categories from a service provider point of view:

1) customer / user pays for the service. This usually is implemented in revenue share model, when there are two or more parties involved in developing the service. This means that when customer pays the service fee the revenues are divided between the providers or enablers with mutual contract. A mobile operator or a mobile device manufacturer can, or automatically is, a revenue share party because of their business logic. This model does not exclude 3rd party funding, e.g. from commercial actor or from public sector.

For example in Pulp friction case revenues share parties could be Destia and Logica if assumed that FMI is involved in a public sector role.

2) service is free of charge but some actor, a commercial sponsor or a public sector body pays the investment and fixed up-keeping costs at least partly.
This case represents either a) a marketing, positive image rationale or b) societal, socio-economic value -rationale to finance the service. In both cases an actor recognizes that by financing the service the returned investment creates added value.

6.2 Main challenges / barriers

Main challenges can be recognized in three main categories: data quality, pricing/ willingness to pay and mobile handsets application version control.

Data quality is now a problem in a case like pulp friction where the source data provider actively develops the data and modelling. In a case where the data is acquired from a public source without contractual commitments (e.g. SLA=service level agreement) no further quarantees for the data can be given by the service provider.

Mobile handsets version control is a challenge which is created by multiple versions of different mobile devices and OS (operating systems). In the pulp friction case the pilot application is created to S60 version 3rd platform and every time a new OS version comes out it must be versioned and technically tested. This means resources usage and product management.

Price adjustment is also a challenge. When offering a service for free for a certain time of period the service provider easily loses the option to add a price tag for that particular service or application in the future. Customer behaviour and rationale for use is a challenge, especially with services which are a part of your everyday life, even adding safety, but not necessarily outreaching individual motives for use or willingness to pay.

7. Conclusions

This deliverable D7.2 discusses the potential business models of transport information services, focusing on the pilots and ideas developed in Roadidea. The previous version D7.1 reviews the main concepts of business modelling in the context of transport information services. Also collection and analysis of business models of a sample of current European transport information services have been presented in D7.1.

Roadidea has resulted in different levels of developments: ideas, “theoretical” pilots, or pilot concepts and pilots, which have been realized as prototype services. The pilots are described more in other work packages of Roadidea (WP6, WP8). In WP7 the pilots have been viewed from the business modelling viewpoint; what could be the potential business model in the future. This includes the identification of potential users, considering the benefit and value of the service to different stakeholders and users and assessment of different financing strategies. The more developed pilots are analysed in more detailed a level than the ideas which have not yet been piloted.

As a result, the main conclusion from the financing point of view is that so far the willingness of end users to pay for the services has not been sufficiently high to base the financing purely on end users. In a discussion in conference session in ITS Stockholm 2009 it was concluded that so far there are no known transport information services in Europe based on customer payments, which have proved their sustainability over time.

Instead, different combinations or mixed models seem to be needed. I some cases it is seen reasonable to use also public funding for the services which have a high societal impact. The mixed models may combine end user payments, advertising, sponsors and public funding. One alternative to be reckoned is to combine the transport information services with other types of information or “real” services, for example with social media or transport or tourist services.

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