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# POSMETRANS

POlicy measures for innovation in TRANSport sector with special focus on Small- and Medium sized Enterprises - factors and recommendations for success and sustainability -

# Deliverable 3.3

Market adoption of innovation including analysis of the survey and validation / identifying of "best practices" in relation to different policy measures

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### 1. Summary

The purpose of this report is to present the conclusions about how innovation spread into the transport market. The conclusions have been obtained following several steps that define the analysis methodology:

- Data collection of innovative technologies
- MCDA analysis of innovative technologies and stakeholders
- POSMETRANS surveys to stakeholders
- Validation of primary findings by Expert Panel
- Final conclusions

The first section of this document has the aim to present best practices identified regarding several innovative technologies adopted in the transport market. The selection of these cases is based on the analysis of data collection and surveys trying to cover all technological fields within transport sector. Then conclusions focused on best practices are extracted for the identification of key factors of how innovations are spread into the transport market.

The last section of the report present the conclusions focused on stakeholders. Here the aim is to synthesize main findings obtained in POSMETRANS surveys and contributions extracted from Expert Panel regarding what is the role of different relevant stakeholders involved on innovation chain within transport sector. Within this section we present how stakeholders are involved in different innovative technological areas studied in the project, how stakeholders face the innovation within their organizations and how could SMEs overcome main barriers.



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# 2. Introduction

Progressive European integration has lead to a substantial increase in transport volumes in recent years. These developments have lead to an increasing recognition of the negative effects of mass transport in Europe, including increasing oil import dependency, air and noise pollution, substantial amounts of GHG emissions, deterioration of infrastructure, congestion, injuries and deaths.

In this context, the development of new innovative technologies to cope with these problems is seen as the key for future sustainability and global competitiveness.

POSMETRANS aims to analyse how innovative technologies reach the market, through the collection of information on different technologies and identifying success factors and barriers in innovation processes.

The purpose of this report is to present the conclusions of the analysis done in the work package 3 regarding how innovation spread into the transport market. Primary results of this analysis were presented to an Expert Panel on 11<sup>th</sup> May 2011 at the Transport & Logistic Fair in Munich (Germany). Experts were asked to discuss some topics extracted to the primary findings from deliverable D3.1 to get their feedback and gather new contributions. Some recommendations and new contributions were taken into account to complete the primary findings. Final results are presented in this document.



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## 3. Best practices "Market adoption of innovative technologies in surface transport sector in Europe"

Electro mobility – Acciona (Spain)

Electric vehicles could be part of the solution for urban mobility, but not for long routes. For this, it should be considered all other propulsion technologies, either alternative fuels or renewable sources. Alternative fuels should be considered as a viable technology to increase fuel efficiency in vehicles.

With the integrated strategy promoting electro mobility ("Estrategia Integral para el Impulso del Vehículo Eléctrico") from April 2010 and the related action plan ("Plan de Acción") from November 2010 the Spanish government has defined its priority for the electro mobility in the near future (overall programme name is Movele). The aim of the strategy is to have on Spanish roads about 250,000 electro and plug in hybrid vehicles until 2014 (until 2012 about 70,000); 85% in large public or company fleets and about 15% in private individuals ownership. It is planed that about 145 Spanish cities with more than 50,000 inhabitance will create an e-mobility environment ("Ciudades con Movilidad eléctrica, CME") The action plan converted the overall strategically aims in concrete policy measures. The overall budget for realising the strategy was fixed with 2.9 bill EUR between 2011 and 2015.



Within this political framework ACCIONA has positioned itself as a supplier of charging infrastructures for electric vehicles by developing an integral system that includes charging points and their operation and the provision of associated information and management services.

As an electricity producer from renewable energy sources, ACCIONA also offers its customers the option of supplying green energy certified by the Spanish National Energy Commission (CNE). This ensures the sustainability of both the operation of the vehicle and the process used to produce the energy used to power it.

ACCIONA is, therefore, in a position to promote the deployment of electric vehicles by providing services in terms of charging infrastructure, operational information and the supply of renewable energy. To do this it has signed collaboration agreements with a wide range of sector operators (automobile manufacturers, car park management companies and public



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administrations) aimed at promoting charging services for future users. It also works with technology providers (Ingeteam, Indra) to find the most advanced solutions.

The first results, in the form of operational charging posts, are already visible on the streets of Pamplona, in the high-speed train stations of Valencia and Madrid and in the Parquesur shopping mall in Madrid. They have also been installed in a number of ACCIONA's offices/plants. Until April 2011, it had installed around thirty, but expects to pass the 100 mark by the end of 2011 and reach much higher figures in later years.

The company's positioning in the field has had a very good reception from the market, and it has already signed cooperation agreements with automobile manufacturers (Renault-Nissan and Daimler-Benz), a multinational shopping mall management company (Unibail-Rodamco) and the Comfersa company for the installation of over 60 charging points at railway station car parks in a number of Spanish cities, including the high-speed train stations in Madrid and Valencia.

#### LNG fuelled vessels in Norway

In case of maritime transport, considering the power demands for propulsion emissions will not change if current propulsion systems do not change extremely. Alternative energies such as electricity, wind, fuel cells... will only support small vessel. LNG could be the most important alternative but it requires more space on board and new bunkering technologies. Innovation has to cope with both issues to make this possibility more efficient and cost effective.

To accelerate the shift to low carbon vehicles and ships and get the impact on market, coordinated and coherent policy instruments such a regulatory framework or make on fuel efficiency would have to establish all around EU.



As best practice, we point out a case in maritime field. We find that Norway has the largest fleet of LNG fueled ships in the world. There are at least 11 ferries fueled by LNG in operation today. The Norwegian combination of a modest charge, by national emission taxes, and generous grants appears to provide a better incentive to make ship owners invest in advanced methods for NOx abatement. This combination has been the primary driver in the adoption of LNG fueled ferries. As result of this policy measure, emissions from the maritime transport decreased whereas the emissions from liquefied natural gas (LNG) plant and industries increased. This initiative could be considered as example and could be applied in other transport industries in order to support the change to a more sustainable transport networks all around Europe.



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#### Electric Locomotive - E6ACT DRAGON (Poland)

In case of railway transport the priority should be given to the efficiency improvement of electric engines and components. Even though the railway mode is green, the energy efficiency will go on improving in the framework of the White paper targets of decarbonisation and reduction of oil dependency. (regeneration of energy, storing of energy in the different parts of the railway system, global management of energy through strong interactions between infrastructure and rolling stock).

Rail offers a perfect opportunity, being already highly energy efficient and electrified to a degree of 80% of rail traffic volume. Electricity will be the dominating fuel for railways; hence this needs to be supplemented by carbon-neutral power generation. For the non-electrified part there will be a mix of solutions like bio fuels of 2nd, 3rd or 4th generation, different hybrid systems, later supplemented by innovative propulsion systems.



As best practice in railway transport it can be mentioned the polish electric locomotive E6ACT DRAGON (See figure). This locomotive is the first, after a long time, Polish locomotive design, developed by ZNLE S.A., one of polish leader of rolling stock manufacture, working in cooperation with research institutes, Electrical Engineering Institute in Warsaw and EC Engineering in Cracow. The locomotive is designed to move heavy freight trains. The project was preceded by a survey of customer needs and considerations reflecting the existing infrastructure in Poland, as the locomotive was designed primarily for the Polish market. The most up-to-date technologies have been included in the locomotive design, and the driver comfort and maintenance standards have been kept at European level.

This locomotive was developed with support of polish policies such as State Transport Policy of Poland (2006-2025), which put emphasis on development of rail in Poland. Polish vehicle fleet is very old, in bad condition, and has negative influence on environment. So one of the priority directed by document is modernization and development of vehicle fleet. One of the direct of railway development say about improvement in incentives system to encourage private funds in development undertaking in railway transport.

The sate of art in Polish technology is rather not rich, taking into consideration necessity of carried out and supporting the research under new solution (mentioned in transport policy abowe) and the fact that this locomotive is first electric locomotive manufactured in Poland



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after 20 years. This locomotive included innovative technologies, construction, corresponding to the EU standards. Because of application of special construction elements, not applicated so far, the negative impact of vehicle on environemnt was significant decreased.

#### Lightweight materials for vehicles - BMW

The automotive industry is driving toward lightweight materials because of an increasing focus on emissions reduction and increased fuel economy. This trend has opened up an array of opportunities for plastics, aluminium, carbon-fibre and other high-tech materials.



The shift towards lightweight materials, such as carbon fibre and aluminium, is partly being driven by the development of electric vehicles. Companies have to offset the fitment of big, heavy battery packs that can add more than 300 kilograms to the weight of a car.

BMW revealed a range of new electric vehicles that will rely on extensive aluminium and carbon-fibre panels to offset the weight of their battery packs. BMW's recently unveiled i3 and i8 electric and hybrid vehicles have an aluminium chassis and the cabin is made of high-strength but extremely lightweight carbon fibre-reinforced plastic. BMW claims this cancels most of the weight added by the batteries.

We find that most of the main car brands have several development programs involving advanced materials, but to get success in the market uptake there should be a balance with cost. Mainstream manufacturers always have to balance the weight savings benefits with the extra cost of using more exotic materials. Therefore, market adoption process depends on how the new materials are getting cheaper and cheaper in production.

#### Low friction coatings for vessels - Maersk

Vessels have lower friction and are able to reduce fuel costs when their hulls are clean and smooth, free from fouling organisms, such as barnacles, algae or molluscs. Low friction coatings are applied on hulls to limit the growth of such organisms thus increasing speed and reducing fuel consumption.

Low friction coatings are a key area to research in the maritime materials field. The faster and the larger is the ship, the most noticeable is the fuel consumption reduction, so big shipping companies are the target of hull coating manufacturers.



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The use of new materials for developing low friction coatings should take into account the environmental impact of their appliance. After first trials, it soon became clear there was a price to pay for the efficient anti-fouling paints containing TBT - tributyltin. Environmental studies provided evidence that TBT is toxic and act as a hormone disrupter. This prompted many countries to act and enforce some restrictions on the use of TBT in anti-fouling paints. Due to these regulations, the actual trends and the investment area are non-sticking coats, which impede the marine flora and fauna to adhere the ship due to the smoothness of the surface, rather than adding any toxic compound to the painting.

According to an IMO regulation, which enters into force in September 2008, TBT paint is to be phased out. Maersk decided to start a phase out of TBT in 2000 and has applied TBT-free coatings since then, and will thus comply with the IMO Antifouling convention well ahead of time. As of early 2007, all of Maersk vessels are TBT-free.



As an additional step, Maersk started application of biocide-free silicone based paint in 2003, which is applied whenever feasible. Today, more than 50 container vessels have had environmentally friendly silicone-based foul release coating applied.

As part of ship owners effort to improve the environmental performance and reduce fuel consumption constantly strive to substitute these products with more environmentally friendly ones without loss of efficiency or increase of cost. It is seen that the amount of chemicals used per vessel on average has increased from 2005 to 2007. The increase has approximately 15%. This is mainly due to the average size of the vessels has increased, hence average amount of chemicals and coatings used.

#### Cargo handling transfer systems in Europe

Modal transfer hampers the competitiveness of intermodal transport. For this reason, R&D is concentrating on fast, cheap and efficient transfer systems. There are many new developments of horizontal transhipment techniques that offer a wide range of opportunities to those transport entrepreneurs who cannot use UCT (Unaccompanied Combined Transport). The basis for sustainable shift of freight from road to rail and an intermodal transmission from accompanied to unaccompanied combined transport is to provide technical solutions which allows easy and cost-effective handling of cargo, especially to load not-craneable trailers on rails.

All around Europe we find different initiatives of innovative cargo handling solutions (Rolling Road, Metrocargo, Modalohr, cargoBramer, NETHS, IUT, ISU, MegaSwing, SITi Project...)



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that had been implemented as pilots. According to the final report of European study InHoTra (Interoperable Intermodal Horizontal Transhipment) we can point some conclusions.



Some of innovative technologies considered within cargo handling solutions needed a totally new designed loading unit or a re-design of existing loading units also with additional pieces of equipment (adapter) such as an intermediate platform between loading unit and transfer system. This is the most important barrier for the commercial actors in intermodal transport and the main reason for not spread these solutions into the market.

The investment needed in such vehicles would only make sense if the system was fully introduced and maintained throughout the depreciation period. Such horizontal transhipment technologies are most likely to succeed which are based on existing loading units and existing rolling stock.

#### Control system for handling and warehousing - Novara Freight Village (Italy)

Centro Interportuale Merci (C.I.M.) SpA provides engineering services and management consultation. The company maintains the intermodal network called Novara Freight Village (Italy). In the last three years, CIM s.p.a. developed, through a software company specifically committed to the study of technological innovation for logistics, an innovative managing and controlling system for handling and warehousing activities within rail and intermodal terminals, as well as for warehouses and multimodal transport operators. For this project, a software platform has been developed, integrating the typical procedures of an intermodal terminal, including all the steps of the production cycle (transport, receipt and warehousing).



As far as the development of the ICT department and, in particular, of the innovative system for handling and warehousing, an extremely important key factor has been related to the



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decision to make the software house in charge of its development work directly within the terminal. Thus, all the specificities of the terminal have been better considered and understood, with the result of a final product perfectly tailored on its needs. In fact, such a solution made possible an effective integration between the informatics knowledge of the software house and the awareness on logistic matter provided by persons with a long experience in this sector.

#### NFC Integrated ticketing in urban transport

Innovative co-modality technologies in public transport are those solutions that facilitate to travellers the use of intermodality in urban transport. One of the most important technologies which is already developed and deployed for this applications is NFC (Near Field Communications), recently adopted in some European cities.

Get on a train, a tram or a bus, or park a bike in a rental stand the only ticket is needed is a mobile phone. Intermodal use will be made that much easier with NFC mobile phones. This intermodality already exists for some parts of urban mass transit: in the Paris region with the Passe Navigo or London with the Oyster card.

The telephone will extend these services to other cities and other means of transport (taxis, car pooling and more...). In addition, this will be consistent with investment made by cities over the last few years, since contactless terminals and card readers already use NFC technology. The NFC phone is like installing the Pass Navigo, Korrigo, Oura, etc. all on the same mobile phone. A technological breakthrough that will help local governments heighten the attractiveness of mass transit that is evidently more environment-friendly, and that will also change the lives of users.



The innovation is the possibility of purchasing and recharging a transit ticket without having to line up at a ticket window. The user can make a secure connection anywhere and at any time of the day or night. This feature could be of interest not only to occasional users of mass transit, but also to foreign visitors or business travelers, etc. NFC is an international standard soon to be installed on most new mobile phones.

In 2007, 200 users of mass transit in Grenoble (France) could travel with their ticket charged with their mobile phone on 3 tramway lines and 28 bus lines serving 26 municipalities in the greater Grenoble area. The experiment was conducted with the semi-public company SEMITAG that manages mass transit in the greater Grenoble region. It tested the purchase of tickets with mobile phones, their validation on existing terminals and the use of NFC tags to provide traffic information and alerts.



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#### <u>Traffic Management Centre – Torino (Italy)</u>

By integrating technologies for information, communications and control, ITS enables authorities, operators and individual travellers to make better informed and co-ordinated decisions. For example, ITS can enable more effective planning, help travellers and freight distributors to avoid delays and congestion, and increase the productivity of transport operations. In addition, ITS applications can reduce energy use, accidents and environmental damage.

An interesting case to highlight as a best practice concerning the improvement of urban mobility of people in Turin (Italy) is the work performed by the consortium 5T (Telematic Technologies for Transport and Traffic in Turin). The aim of this consortium is to implement telematic technologies to help achieve better mobility in Turin. The 5T project was launched as a pilot project in 1992 in order to help citizens move round the city more quickly, encourage use of public transport and reduce pollution. The exceptional results of this pilot project, verified by International Organizations, have demonstrated the effective contribution of integrated telematic systems to improve mobility.



Therefore, in 2000 the 5T consortium was transformed into an S.c.r.I. (Limited Liability Consortium Company), controlled by Gruppo Torinese Trasporti (GTT), and with the participation of the Turin City Council. Now it is entitled to the management, integration and development of telematic technologies, in order to improve urban traffic and public transport. Over the years, 5T has expanded from a simple project into a real operating system that provides citizens, GTT and the City with top class services and capabilities.

It can be seen as a best practice since, beyond standard sectoral implementations of ICT technologies in specific ambits (traffic lights management, priority to public transport, VMS, pollution monitoring...) that are nowadays diffused in most European cities, it has an integrated and holistic vision that allows for the coordination of a wide range of telematic devices to work together for a common goal.

Furthermore, it is a good example of practical cooperation among research actors and public actors, which will be directly involved in the elaboration of public policies concerning urban transport and mobility management.

It is the case to remark that the Regional government recently entered this consortium, with the intent to extend its mobility management system to the whole region in the future. Such a consortium is already in network with other similar bodies throughout Europe, such as the



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ones in Birmingham and in Stuttgart, which has lead to some interesting knowledge exchange.

#### The European Rail Traffic Management System (ERTMS) - Cambrian Line in Wales (UK)

In the railway sector, The European Rail Traffic Management System (ERTMS) is a major industrial project being implemented by Europe, a project which will serve to make rail transport safer and more competitive. ERTMS is an initiative backed by the European Union to enhance cross-border interoperability and signalling procurement by creating a single Europe-wide standard for train control and command systems. The two main components of ERTMS are the European Train Control System (ETCS), a standard for in-cab train control, and GSM-R, the GSM mobile communications standard for railway operations. The equipment can further be subdivided between on-board and infrastructure equipment.

The expectations on ERTMS are not low. When more countries use ERTMS systems trains should be able to pass between countries without having to switch either engine or driver. The same driver would be able to, theoretically, drive from Norway to Italy and would only have to know one single signalling system, since they all would behave the same way. This will reduce costs for operators, as they would not have to lease properly equipped engines when the trains cross country boundaries. And costs will be reduced for suppliers, as spare parts will be close to the same everywhere and only minor changes will have to be made in the software for each country.



This year UK submitted the ERTMS National Implementation Plan to the European Commission to comply with a series of EU railway directives and commits the UK to installing the next-generation system on 72% of the National Rail network between now and 2038. The Cambrian line in mid-Wales is the testbed for ERTMS in UK and once the scheme is completed it will become the first railway in the country to benefit from this new technology. The test run is vital to determine the readiness of this new system before it is introduced in phases on the Cambrian line and subsequently across UK to bring a more reliable railway, as well as the prospect of more trains to passengers.

This is a pilot project which aim is to learn how ERTMS can work in a UK context and learn what are the main technical barriers, being an excellent experience of the problems of trying to convert an existing railway.

#### EGNOS for dangerous material transport – SCUTUM



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The European Satellite Navigation system EGNOS (European Geostationary Navigation Overlay Service) is operational and provides services since October 2009. EGNOS services added value, compared to GPS, relies on its ability to provide enhanced accuracy and confidence in the position, suitable for applications requiring precise and reliable localisation. The availability of EGNOS over Europe enables tracking & tracing services based on guaranteed positioning, suitable for applications requiring precise and reliable localisation. In the dangerous goods transports, EGNOS has evident opportunities in the short term in Europe, and in addition prepares the global market for Galileo.



The SCUTUM project succeeded in a wide adoption of EGNOS in Europe for tracking & tracing of dangerous goods transported by road. ENI, an Italian leading oil company, adopted EGNOS to monitor its operational fleet transporting dangerous goods throughout Europe, and to benefit from EGNOS proven enhanced accuracy and position guarantee. About 300 trucks are presently equipped with GPS/EGNOS tracking & tracing devices. Their location and information on the cargo are sent to the Transport Integrated Platform for being visualized and sent to the company's emergency management centre. The use of EGNOS enables a robust positioning, thanks to a more accurate information on the position of the vehicle and to the related level of confidence. This is linked to the guarantee of the position, ensuring higher safety and giving the possibility to exchange reliable information with authorities and transport operators.

SCUTUM leads to the development of EGNOS CS products and services ready for the commercial market. It proves EGNOS benefits for road applications and exploits the value of EGNOS position accuracy and guarantee for tracking & tracing of dangerous goods. SCUTUM also specifies the standard for the implementation of EGNOS commercial services in Intelligent Transport Systems and mobility applications (CEN Workshop Agreement SCUTUM). Italy's and France's Ministries of Transport validated the technical standard for the implementation of EGNOS commercial services, as part of a shared vision for EGNOS adoption.

#### Transport XML – Norstella (Norway)

ICT technologies will be needed to support the integration of different transport modes in an intermodal transport system for the seamless and efficient transport of passengers and goods. Those technologies need EU coordination to ensure standardized spezifications and coordinated deployment.

As best practice in this field, we find the TransportXML standard developed by Norwegian EDIPRO through a NorStella research project in the period from 2001/2002. TransportXML is



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a XML based standard for electronic collaboration within and/or with the transport and forwarding industry. It is now used by the transport industry in Norway through the transport portal TakeCargo. EDIPRO was established in 1994 as user oriented, independent, non-profit, private foundation to implement EDIFACT for transport messages, and to use EDIFACT for customs clearance.



After TransportXML was established, EDIPRO was renamed to NorStella in 2003 (curiously coinciding with the project name) and was appointed by the Norwegian Government as the national contact point for all international standardization activities in the field of electronic business and trade facilitation. NorStella has recently been given the role as a lead partner for developing transportXML to cover the short sea-industry, and hence be an European standard for intermodal transport. Based on international standards (ebXML as developed by UN/CEFACT), it is expected to be a global standard for all kind of transport and forwarding.

#### Gate security systems – European ports

In the other hand, the initiatives for the *security* of the transport chains have accelerated rapidly since 9/11, not only for aviation, but also for the rest of modes especially for the shipping industry. Focusing on ports, the identification of all people entering a port area is not a simple or easy task. By one side there are permanent needs, such as for port workers or other authorities such as maritime, custom and, security bodies, or companies and industries with activities inside the port with long term contracts.



There are already existing gate systems in the European ports, AlfaPass in Port of Antwerpen, XSKey PortKey in Port of Rotterdam, RHIDES in Port of Felixtowe, GAB in Port of Ghent. Those systems are addressed to identify first vehicle (truck or train) entering the port via road, and the truck or car driver. The vehicle identification methods are based on OCR, RFID, while the driver identification is supported by, magnetic cards and biometric



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readers technologies RFID based Automatic Equipment Identification Systems (AEI) for port Gate Systems is becoming widely used for Vehicle ID.



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## 4. Conclusions focused on Best Practices

When we speak about innovative technologies we refer to those technologies already spread into the market, or those technologies that are being deployed in some markets. This section focuses on several best practices within both groups of technologies in order to draw some practical conclusions and recommendations.

**Greening technologies** are technologies oriented to deploy the emission of greenhouse gases and VOC, by means of increasing the efficiency of the vehicles, making them to consume less fuel or switching to cleaner fuels or, in an optimum scenario, using renewable energy sources. There are many technologies that can increase the efficiency of the vehicles such as considered in next group (e.g. lightweight materials, paints and coating in ships...) but we focus this analysis in those that have higher impact in reducing fuel consumption and dependency on fossil fuel. Technologies considered in the analysis are electric-vehicles related technologies, alternative fuels and renewable energy sources applied to the propulsion of vehicles.

- As European Commission states in the communication (COM 2010-186) of "A European strategy on clean and energy efficient vehicles", a "greening" of the European vehicle fleet will only be successful if consumers are indeed choosing to buy clean and energy efficient vehicles. Nowadays, due to their advanced technology, green vehicles are however still significantly more expensive than conventional ones. Involvement of consumers and demand-side incentives are therefore important to encourage market uptake. This statement can be extrapolated to all surface transport modes.
- Almost all member states have introduced CO2 emission based vehicle taxation schemes, while others have adopted or are considering specific incentive schemes, many of them financial, to encourage consumers to opt for greening solutions.
- In the case of electric vehicle, an important point to take into account is the implementation of the charging infrastructure and technical standardisation. The case of Acciona described as best practice is an example of a pilot charging infrastructure that is available today. Spain and other advanced European countries have already planned the deployment of such infrastructure for the first electric vehicles arriving to the market in 2011. European Comission should launch an initiative to quickly define the most important standards in order to facilitate mass introduction at European level.
- In the case of LNG fueled vessels, we see that Norwegian has positioned as a pionner in the use of LNG as fuel through an innovative initiative based on the combination of emission taxes and grants for support vessels refitting from conventional fuels to LNG.
- Concerning rail transport we see an example of how greening technologies applied in rail transport are supported by polish government in order to improve and modernize polish rail fleet. In this case, E6ACT DRAGON locomotive is a clear example of how



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an innovation reaches the market through government support and public-private collaboration.

In addition to propulsion, other important area is the application of light, smart, innovative **new materials**, which also plays an important role for further improvements in efficiency and lower energy consumption. New materials are well positioned in the market, as example new materials solutions as lightweight materials for vehicle, new materials for wheels, antifouling materials in ships, etc. This is an important area that to get new solutions as well as one of the most important area in which improvements can transform the European transport sector.

- The European automobile manufacturing market is advancing with the introduction of new lightweight materials and the development of innovative structural designs to reduce vehicular weight. The reason for the rising demand for lightweight vehicles is to meet the European Union's targets for the reduction of CO2 emission by 8 per cent within the period 2008-2015.
- As a result, vehicle manufacturers are increasingly willing to pay a premium per kilo saved on the body structure, for supporting emission targets. Enhanced fuel efficiency and power-to-weight ratio, while maintaining comfort and safety features, are also considerations that have underpinned the search for lightweight structures.
- However, trying to maintain an optimal balance between cost and weight remains a key challenge. The use of innovative materials is often accompanied by limited knowledge on how to capitalise on the use of these new-generation materials in manufacturing. This, in turn, may cause production difficulties resulting from the high cost of manufacture.
- Concerning low friction coatings for vessels, we can conclude that development and deployment of these new materials required high investments. Mostly big shipping companies with large and fast ships have adopted antifouling technologies. As we pointed, one of the pioneers using these types of materials is Maersk shipping company, which applied these coatings to its fleet, which has very successful figures regarding consumption and efficiency use of energy, due to the low resistance that these coatings provide. However, due to the current fuel prices scenario, the option of using innovative hull coatings is becoming attractive for smaller ships with even low speeds.

**Co-modality technologies** play an important role within technological solutions in the development of a more sustainable transport system. Improving co-modality and develop better interfaces for seamless door-to-door transport chains is seen as one of the research areas with large improvement potential, whilst competition should focus on the performance within the transport chain rather than on performance between the different modes. As analyzed it would be remarkable the importance of intermodal platforms for freight chains and integrated ticketing in public transport as innovate solutions that can obtain success for sustainable freight transport chains and urban mobility.

• Regarding freight and logistics we can conclude that the basic problem of intermodal transport is the additional cost of the transfer. While unimodal transport can move from ramp to ramp, from ware-house to ware-house without intermediate transfer of



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goods or of loading units, intermodal transport necessarily includes 2 intermodal transfers. The additional costs of such transfers hamper the competitivity of intermodal transport; they must be compensated by other advantages in cost or quality. The greater the costs of transfer, the more compensation are needed.

- No innovative solution mentioned in this field is on the market because of the costs for the investment. Another reason of this unsuccessful adoption is the necessity of a massive change of the processes within the railway operators. Obviously the railway operators do not want to change the existing processes. From this point of view the development of an low-cost system would have been a more promising approach. Innovative solutions have to be addressed in order to get more cheap and efficient transfer systems which promote intermodal transport chain and make profitable the investment.
- In addition to new solutions for cargo handling infrastructures we find that ICT is another application field that can improve the efficiency of cargo flows in freight villages and consequently improve the efficiency of intermodal transport chains. Control systems for handling and warehousing is based on the concept of the control center well known within the airports, and integrates a technological platform for real-time information management, with all the most popular technologies for terminal board data acquisition via GPS / GSM / GPRS / UMTS / WIFI for the management of vehicles and containers in transit. As we analyzed in the case of freight village in Novara (Italy) a key factor to have success in technology deployment is that the software house in charge of its development works directly within the terminal making possible an effective integration between the informatics knowledge of the software house and the awareness on logistic matter provided by persons with a long experience in this sector. Here we can point out the importance of implication of end user in the innovation chain.
- In the other hand, the adoption of integrated ticketing has to face many barriers of technical operational and social nature. The feasibility of integrated ticketing becomes a major problem as a result of the many transport environments and differences between these environments. Usually, railways, regional and urban public transport operators all have different fare policies and models together with different subsidy models. The incorporation of operators into a single fare structure is a gradual process.
- With the advent of NFC technology is easier to overcome barriers in integrated ticket introduction, and could allow for better information with actual times and departure hours changing in real time. This could reduce problem of search for interconnection which is often encountered in long short distance combinations.
- Political decisions are necessary in regard to financial side of the possible projects. Integrated ticketing demands significant investments in technical equipment (and not only transport vehicles but also IT systems have to be developed). Public transport in majority of countries is subject of government (central or local) care. Therefore financial burden of new integrated connectivity will certainly be placed on the state.



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**Intelligent Transport System** covers all technological solutions based on ICTs focused to provide cleaner, more efficient, more comfortable, and safe and secure transport. ITS concept is based on intelligent mobility towards fully informed people, towards zero accidents, zero delays, with reduced impact on the environment, where services are affordable and seamless, with privacy respected and security provided. During the past decade a lot of effort has been concentrated in research and development of Intelligent Transport Systems and services. However, actual wide-scale deployment of ITS applications is lagging behind. In order to achieve in the future, proper development and deployment of ITS in Europe, it is necessary that many actors come together, such as local authorities, transport infrastructures, vehicle developers, information networks and telecommunication providers.

- One of the most attractive goals in transport sector is to increase efficiency without necessarily investing in new infrastructure, and that is where intelligent ITS can play a key role, especially when working closely with local authorities. The use of the systems up to now realized, both at urban and extra-urban level, allowed to evaluate in a concrete way the benefits from ITS. Data from the European Commission reveals that, in several applications realized in European Countries, reduction of travelling times of 20% were obtained as well as an higher network performance, up of 5-10%, and higher safety, up of 10-15%. These positive results show ITS advantages, in a logic of sustainable development, to the environment, efficiency, citizens safety and to competitiveness and they confirm the ITS key role for mobility policies.
- Concerning systems for infrastructures, in Europe the current situation is that authorities rightly need reassurance through the production of a business case that investment is appropriate. However, there is a limit to the evidence available to them on the actual benefits that will be delivered and the true costs involved. In such circumstances, authorities may decide to avoid change and stay with what they know. This will mean that the potential benefits of ITS are not exploited.
- In situations where authorities and investors do decide to proceed with the development of a business case, it is essential to complete comprehensive research to understand the true benefits of investment in ITS. Unless adequate resources, both time and money, are dedicated to the evaluation of projects and to the reporting of outcomes there is a possibility that weaknesses in the methodology and limits placed on the extent of indicators assessed mean that authorities will remain uncertain about whether to invest further in ITS. Once again, this will lead to ITS being underexploited.
- There are of course some exceptions that could give clues to get success. In the case of Traffic Management centre in Torino, collaboration between public and private partners enables industry to innovate, think long term and influence the public sector. The private sector can manage a 'public' Traffic Management Centre (TMC) to improve efficiency and reduce costs. Identifying an appropriate financial and management model is crucial for implementing, improving or upgrading a TMC. A potential method for financing the development and day-to-day operations of TMCs is through a form of working alliance requiring co-operation of public and private partners. These working collaborations enable the public sector to share financial burden and risk with the private sector.



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- In case of ERTMS applications we find that this technology is often quoted as a problem by industry commentators but Network Rail in UK is learning from its experience on the Cambrian scheme and is planning further implementation across the network. Despite Cambrian case has been converted to something much more complex and expensive that was planned, it is helpful to the rest of the UK. Today almost all major players are publicly committed to working towards the same goal. This demonstrates that ERTMS is a success story making a difference for rail transport: by eliminating burdensome technical barriers to interoperability, ERTMS helps boost the internal market, optimize infrastructure capacities, improve safety and reliability and enable a more balanced modal share.
- EGNOSS case is a good example of well oriented innovation. SCUTUM achievements are in line with the European policies and Action Plans in support of the telematics applied to the freight transport and the use of EGNOS/Galileo, such as the European Directive for the deployment of Intelligent Transport Systems (ITS Directive), the Global Navigation Satellite Systems (GNSS) Applications Action Plan, the Freight Logistics Action Plan and related eFreight initiatives.
- In case of Transport XML, using telematics will allow fully integrated business processes for small and large companies alike. This will allow synergies across. Servers can work together to share information leading to improved coordination and efficiency of transport chains. Telematic standards will contribute to reach more competitive alternatives to traditional transport and will reduce administrative processes, lower costs, reduce errors, improve transparency, increase dynamic planning of the trips, free up staff and improve customer service. However, in practice the application of these communication standard to current transport operatives is a slow process and the costs of modernization of the current infrastructures will be considerable.
- In case of gate systems, technologies analyzed are focused as part of security systems, an issue that always have to form part of the port policy. There is always more that can be done and measures already taken need to follow through and updated to face new challenges. Recent studies made in Sweden on the ISPS-code show those regulations already in force are complied with in different ways which thereby erode the safety as such, so it should be reinforced in the near future with introduction of new technologies and processes supported by authorities.
- As conclusion, the integration of all technologies completing an integrated intelligent transport system is obviously a medium/long term initiative, but one that must be advanced within Europe. An intermediate step would be to equip the vehicles, trains and vessels with the ability to recognize environmental features. This step will bridge this technology gap until penetration of smart features is sufficiently thorough to result in the desired benefits. Developing standards that many manufacturers can follow and transport industry can become accustomed to will go a long way toward improving the penetration of technologies in the transportation market.



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## **5. Conclusions focused on Stakeholders**

These conclusions synthesize main findings obtained in POSMETRANS project regarding to the role of stakeholders in market adoption of innovative solutions in transport sector. Following we point out how the stakeholders are involved in different technological areas, how they face the innovation within their organizations, and what are the main clues for SMEs to overcome innovation barriers.

On one hand, the analysis of best practices gives us an overview about how the technologies are spread into to the market within the different technological fields considered in the project. In the other hand surveys and contributions from expert panel give us information about how stakeholders face the innovation within their organizations and what are their preferences concerning different technological fields. This section link both aspects and present main conclusions focused on different stakeholders studied.

### 5.1. How stakeholders are involved in different technological areas

Surveys give us clues about how is the role of stakeholders in relation to technological fields studied in the project. The following summarizes the conclusions drawn for each group: companies, networks, research institutes and public bodies. In charts, technologies are evaluated by stakeholders from 0 (insignificant) to 5 (major role) related to degree of relevance in the daily activity.

New Material technologies are not included in the selection of technologies at the survey, due to the technological profile of the experts surveyed, which was more oriented to ICTs and the other technological areas. From this fact, we can conclude that New Materials, in spite of being strongly spread in the market, are not the main strategic fields of research for entities among transport sector.

#### Companies



*ICT* is the best technological field in terms on industry participation since the high number of applications already exists and high potential for innovation in transport sector.



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- Transport optimising solutions are the most valuated technologies by companies surveyed within this field and it would be considered as best technology positioned in the transport market. According to the market research from the independent analyst firm Berg Insight, the number of fleet management units deployed in commercial fleets in Europe will grow from 1.5 million units in 2009 to 4 million in 2014. This is a very big potential market for the technology providers.
- Development of "Intelligent Transport System" services requires collaboration between public bodies, transport providers and transport and technology industry, which enables industry to innovate, think long term and influence in the public sector. It is necessary that all actors involved in transport sector work together towards a successful spread of ITS at national and European level.

*Greening technologies* are considered currently the field less spread into the market than the rest of fields analysed.

- These technologies are currently in transition from technology development to
  product development. Due to their advanced technology, green vehicles are however
  still significantly more expensive than conventional ones; as well autonomy limitations
  and electrical infrastructure dependency are barriers that make green vehicles less
  attractive for consumers. Industry effort supported by effective policy measures must
  overcome those barriers and get spread green mobility all around Europe.
- The complicated economic situation in Europe does not currently favor companies to invest in greening technologies, preferring to invest in more profitable technologies in the short term as ICTs. Financial support and supporting policy measures by public bodies is needed to keep improving in this field.

*Co-modality* technologies are valuated under ICT field. It is considered as one of the greatest challenges in the future in the transport sector in Europe.

- Regarding freight and logistics, the problem of industry is based on the barriers for change the existing transport services. Apart from investment needed to adopt new solutions based on ICTs or new infrastructures, intermodality in freight transport requires a massive change for transport operators and transport staff. ICT based solutions have high potential in order to improve effectiveness in intermodal transport chains. Key factors for companies are: develop of in-house solutions, implication of end users and training of personnel.
- Regarding public transport, integrated ticketing is considered as non-spread technology. Only some urban regions work under this public transport concept. There are some success cases of this technology but currently is mostly under study because of the high-level of coordination and co-operation needed between all public transport providers and the suppliers.

#### Networks



 

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 NETWORKS



According to the surveys, there is not a clear difference between the preferences that networks have in relation to different technological fields. There are of course institutions oriented to the promotion of specific areas, but generally networks have a multidisciplinary role in regard of support the spread of new technologies in transport sector. Following, we point how networks deal with different fields:

- Networks have an important role for the proper development and deployment of ITS solutions by encourage the collaboration between all actors involved in transport sector, towards the generation of innovation through knowledge development and transfer solutions to the transport.
- The promotion of standardizations is a key role for networks in order to boost the involvement of all stakeholders in the definition and integration processes
- Networks are closely involved in the promotion of intermodal transport. They are in charge of promotion intermodality encouraging the collaboration of all actors involved in the transport chains, both in freight and logistics and public transport. Networks support standardization and interoperability between actors involved in intermodal transport.



### **R&D** institutes



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The graph shows what the preferences are and how R&D institutes support different technological fields within transport sector.

- As it can be assumed ICT technologies is the technological filed highest supported by R&D institutes. That has sense since ICTs is the most spread technological field within transport sector.
- ICTs are closely followed by greening technologies. Currently these technologies are in transition from technology development to product development. These technologies are under no exploitation phase; R&D sector is making a great effort within this field. This can be analysed by reviewing the allocation of funding for R&D for greening transport.
- Finally in last position, co-modality is the field less supported by R&D institutes. One of the main challenges for adopting new co-modality technologies in the field of freight and logistics is to provide new applications to make feasible and more attractive the use of alternatives transport modes for transport hauliers. R&D institutes have the challenge to promote and contribute to standardization of information exchange between all transport modes to overcome administrative barriers.



#### **Public Bodies**

We find *ICT* at the bottom of the technological fields valuated by public bodies. In this case ICTs came to be considered as less interesting field, in comparison to high valuation obtained by companies.

 The role of administrations is important for the modernization of transport infrastructures with new systems based on ITS. European Commission reveals ITS advantages in terms of efficiency, safety and sustainability, but currently there are limits to the evidence on actual benefits and true costs involved. It means that the potential benefits of ITS are not exploited. Resources (time and money) to evaluate real benefits and real costs of business cases are essential for spread of ITS solutions.



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- The role of administrations is also important for developing standards for vehicle manufacturers and industry. This is considered also a key factor to bridge the ITS solutions gap and improve the penetration of intelligent transport systems in the European transport.
- Traffic Management Centre in Torino managed by private sector is a good example of how public bodies can share financial risk, improve efficiency and reduce costs. In some cases cooperation between public and private sector is the clue for innovation success.
- Public bodies should keep improving promotion and support on development of standard frameworks for freight information exchange. In practice it is a slow and expensive process for adoption that need financial support and must involve key stakeholders for its development.
- Safety and security regulations applied to the transport sector foster the application of new technologies in this field. The revision of codes and standards, such as the ISPS code for ships and ports, is necessary to improve safety conditions and facilitate the spread of innovative technologies.

*Greening technologies* is the field best valuated by public bodies. This field is considered by public bodies as priority within the strategy towards the sustainability of transport networks and mobility.

- Almost all European countries have introduced CO2 emissions based vehicle taxations schemes, which promote the innovation towards zero emissions. One priority for administrations would be to analyse the measures and its impacts in each country and transfer best practices from one country to another. As example we have the successful case of Norwegian measures for support vessels refitting from conventional fuels to LNG, based on the combination of emission taxes and grants. Adoption of finalist taxes schemas which promote the market adoption of innovative greening technologies is the most realistic way to achieve the decarbonisation of transport sector.
- Advanced European countries are taking first steps to promote technical standardization for the adaptation of infrastructures to greening transport requirements, for example, charging infrastructure for electric vehicles or LNG supply chain for LNG fueled vessels. Policy measures should be addressed to define standards in order to facilitate mass introduction at European level. We find a lot of pilots (e.g. the charging system promoted by Acciona in Spain) but actions for standardization at European level must be taken.

*Co-modality technologies* receive a middle level valuation from public bodies. Intermodality is seen as a great challenge within transport strategies and many barriers must be overcome.

• Regarding freight and logistics, the objectives of co-modality technologies are to enhance freight intermodal transport, reduce congestion, and improve the environmental performance of European freight transport system. The spread of these technologies is going slow down because of the worse economic conditions



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and lower transport demand attributed to the overall downturn of the economy. Therefore, the role of public bodies is essential for keeping improve the support through financial programmes, such as Marco Polo programme, new schemas based on internalization of external costs in order to support traffic shift from road to other surface modes, and new initiatives to enhance the accessibility of hauliers to a more efficient transport chains.

 Co-modality technologies related to urban mobility are the highest valuated area by public administrations. Urban public transport is subject of authorities care, so political decisions are a key factor concerning financial, coordination, and co-operation matters. Many of the main cities of Europe are promoting this type of services based on success stories of pioneer's cities to give solutions towards sustainability of urban mobility. Financial burden of new integrated connectivity will certainly be placed on the state.

### 5.2. How stakeholders face the innovation within their organizations

In this case surveys give us clues regarding how stakeholders face the innovation within their organizations. Next paragraphs summarize main conclusions regarding how stakeholders perform in relation with innovation strategy, sources of information, training of personnel and factors motivating innovation.

A consolidate innovation strategy linked to organization culture is a key factor to get success in innovation transport sector. There are some good examples within analyzed stakeholders that show up their innovation strategy: technological surveillance, relation to marketing departments and networks, align projects with internal technological plans and relation with main industry actors. The innovation culture in the companies is essential, but customers must prevail as main motivations to direct innovation towards real needs of the transport market.

Sources of information most used by companies are to visit trade fairs and conferences, to be member of a network, and internet browsing as usual. Dissemination of the research projects results in workshops or congress is extremely useful to make enable stakeholders to meet outputs and grow innovation. Networks are in charge of promotional work supporting organizations to be updated so they have to be updated as well. Networks promote the participation in trade fairs and conferences; they also participate in innovative clusters and develop relationships between companies and universities as suitable instrument to approach innovation. R&D institutes are more familiarized to make constant research in scientific journals, visit conferences, workshops or seminars, and be member as well of networks or innovative clusters. Public bodies, as well as in the role of information provider, mainly participates as speaker in conferences, and usually be the contact point of interested organizations in innovation matters. As conclusion it can be considered that there must be more implication of public bodies in the dissemination of information concerning innovation in transport sector through use more instruments as participating in trade fairs, writing articles for networks and improving cooperation with universities.

Innovation culture also implies training for employees. The attendance to external and inhose training courses are a common practices in the transport industry. R&D institutes base



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the training in external courses and networks usually do not spend resources to training internal staff. E-learning for training is not too extended yet among stakeholders in transport sector.

Factors motivating innovation are strong linked with how stakeholders face innovation and which type of innovation strategy is adopted. The main motivation factor for companies is to increase the competitiveness. R&D institutes gives priority to position themselves well between research institute at national and European level, and surprisingly get public funds is prioritized against customers' demand. It can be concluded that the reduction of public funds affect directly to the capacity of R&D institutes. In the other hand, the main motivation factor to networks is the costumers' demand as well as other options pointed such as create new jobs and improve the competitiveness of companies. Public bodies are concerned about both improvement of competitiveness in transport industry and ensure environmental sustainability of transport chains and mobility as motivators to support innovation.

Companies coincide with R&D institutes and networks about financial barriers and funding programmes related barriers as main limitations to innovate. They cannot assume investments without access to public funds, which have the inconvenience of complex bureaucracy. Another aspect pointed by R&D institutes is that the cost of replacement equipments to face new projects is too high. In turn, networks point the lack of qualified personnel focused on R&D management and long-term of the return investment associated to R&D dimension of the companies.

It is demonstrated that stakeholders positioned as medium-tech entities have more difficulties to innovate. In contrast high-tech entities are part of a more specialized group in transport sector and more experienced. This can be comparable to those large automotive suppliers that dominate R&D in Europe and have more impact on innovation than the rest of industry. This situation could be better in favor of SMEs in R&D and innovation. One motivation for SMEs to increase their participation in R&D, which would have consequently more impact in the innovation performances, would be improve on accessibility to research funds for SMEs and make more simply the application rules.

Other remarkable aspect can be considered as general conclusion within this analysis such as the need of the cooperation between stakeholders trying to address the whole transport system as one in Europe. For that purpose, it is needed to provide a global action in order to overcome the discrepancies existing among national solutions.

## 5.3. Overcoming barriers for SMEs

Finnaly, a special mention is made for SMEs, summarizing main conclusions from surveys and contributions of experts.

Main difficulty for SMEs is the lack of pre-funding to innovate. SMEs generally are limited in achieving financial resources for innovation by access to venture capital as well as participation in funding programmes. R&D support programmes can be an opportunity and can be the only widely accessible source of funding.



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One of main difference between SMEs and large companies is that in SMEs decisions often are made by the board of management, whose priorities are more related to the business model and not to innovation, so innovation is not often the focal point. In the other hand big companies have innovation managers and trend scouts who are in charge of decisions concerning innovation and have capacity to participate in R&D programmes and get funds.

Another difference that also depends on the size is the opportunity for collaboration. Large companies have more opportunities to promote collaboration and build new cooperation. In the other hand SMEs have limited collaborations with research institutes and public bodies. Participation in research projects usually is a channel to link with collaborations but also with existing clients and acquire other clients.

To make the access to funds easy and more attractive SMEs need high funding rates, simple application procedures with adequate assistance, low administrative burden and fast times to contract.

But, in spite of getting improve the participation of SMEs in research projects to get funds and new ideas, there is needed improve the co-financing for implementation due to costs of implementation are five times as high as initial development.

As best practices, CIVITAS programme from Krakow can be considered a good example to promote technology transfer and give SMEs the possibility to work first with a small consortium and then implement the technology in another country. The goal of CIVITAS is to support cities to introduce ambitious transport measures and policies towards sustainable urban mobility. It is a good example about how smaller projects are better focused on SMEs.



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