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Executive Summary

INTRASME focused on the changing role SMEs can have on innovation within the transport sector. SMEs employ approximately 55% of the EU workforce in transport, and their important role in the value chain is expected to increase and change, especially in the emerging Low Carbon Transport sector (particularly in road and air transport), where reduced fuel consumption, reduced emissions and alternative power sources requires innovation in a wide range of technology.

The rigid value chain of the transport sector is stifling the introduction of innovation by SMEs into new vehicles and transport-related products. SMEs (usually Tier 2 suppliers) find it difficult to interact with vehicle manufacturers, as they generally have short-term supply contracts to Tier 1 companies, who are strongly linked to specific large volume OEMs. Tier 2 SMEs have no collective voice or influence at European level and the EU is not taking advantage of or directly supporting the thriving innovative companies in this sector.

INTRASME addressed this market failure and focused on the opportunities that new markets offer to innovative and dynamic businesses. Responding to the call for proposals TPT.2012.3-2: 'Bringing innovative products and services to the market: analysis of pathways and best conditions for innovation', INTRASME addressed the European manufacturing capability offered by SMEs of different EU Regions targeting the main goal of "how to bring innovative products and services more efficiently and quicker to the market."

The emerging Low Carbon Transport market was used to examine barriers to innovation and to develop mechanisms to support the innovation potential of SMEs. INTRASME supported the SMEs through the delivery of a series of Roadshows and Workshops whilst the creation of Innovation Networks was supported in three regions. The online Innovation Network Platform, available through the website, facilitated stakeholder interaction and provided information on projects, products, services in the field of LCVs, Light Aircraft and Smart Mobility. Good practices of innovative SMEs and a toolbox containing useful references on commercialisation issues were also made available.

Project context and objectives

INTRASME improved the capacity and capability of European SMEs to more rapidly develop and implement products and services in the low carbon transportation and smart mobility sectors. INTRASME focused on the changing – and increasingly important – role that SMEs have on innovation mechanisms for the transport sector. SMEs employ about 55% of the EU workforce in transport and their important role in the value chain is expected to expand, especially in the emerging low carbon transport sector (particularly road and air transport), where reduced fuel consumption, reduced emissions and alternative power sources require innovations in a wide range of technologies.

In 2010, transport-sector CO_2 emissions represented 23% of global and 30% of EU of CO2 emissions from fossil fuel combustion. The sector accounts for approximately 15% of overall greenhouse gas emissions. Global CO_2 emissions from transport grew by 45% from 1990 to 2007, led by emissions from the road sector in terms of volume and by shipping and aviation in terms of highest growth rates. In the UK, road-based transport currently accounts for approximately 22% of CO_2 emissions. On a wider scale, such emissions are major contributors to global warming and accelerators of climate change. Therefore, there is an identified need to find more fuel/energy efficient alternatives to the current fossil fuels in order to protect the environment as well as the limited energy supply.

As stated in the EU's 2011 White Paper, *the Roadmap to a Single European Transport Area - Towards a competitive and resource efficient transport system*1, the challenge is how to grow transport and supporting mobility while reaching the 60% emission reduction target. In line with the flagship initiative "Resource efficient Europe" set up in the *Europe 2020 Strategy* and the new *Energy Efficiency Plan* 20113, the paramount goal of European transport policy is to help establish a system that underpins European economic progress, enhances competitiveness and offers high quality mobility services while using resources more efficiently. In practice, transport has to use less energy and determine more cleaner energy sources, better exploit modern infrastructure and reduce its negative impact on the environment and key natural assets like water, land and ecosystems.

The EU's *Europe 2020 Strategy, for a resource-efficient Europe* presents a vision for a low-carbon, resource-efficient, secure and competitive transport system by 2050 that removes all obstacles to the internal market for transport promoting clean technologies and further modernisation of transport networks. There is clearly an opportunity for businesses – including SMEs - to develop innovative products and services in this area. However, at present there is a clear market failure within the transport sector; the rigid value chain is currently stifling innovations being developed by SMEs and introduced into new vehicles and transport-related products. The SMEs (usually Tier 2 suppliers) find it difficult to interact with the larger vehicle manufacturers. These larger manufacturers generally have short-term supply contracts to Tier 1 companies, who are strongly linked to specific large volume OEMs, particularly in the automotive and aerospace sector. The Tier 2 SMEs have no collective voice or influence at European level and the EU is not taking advantage of, or supporting directly, the thriving innovative companies in this sector.

INTRASME addressed this market failure and focused on the opportunities that these new markets offer to innovative and dynamic businesses. The emerging low carbon transport market were used as a vehicle to examine the barriers to innovation and

develop mechanisms to support the potential of SMEs in bringing innovations to the market quickly.

Responding to the Call for TPT.2012.3-2: Bringing innovative products and services to the market: analysis of pathways and best conditions for innovation from the RTD directorate, INTRASME addressed a central point of the European manufacturing capability offered by SMEs of different EU Regions targeting the main goal of **"how to bring more efficiently and quicker innovative products and services to the market."**

The primary project objectives fall into 3 strands as described below, reflecting the 3 items highlighted in the Call topic, viz targeting the innovation process in 1) EU-funded Framework Programme research projects, 2) SMEs and 3) establish a selected number of 'Innovation Networks' involving, in particular, regions of Europe where links between actors of the innovation chain are weak. INTRASME will address all 3 strands of the Call topic, with particular emphasis on SMEs, as detailed below.

All 3 strands will focus on three selected cases from the Transport sector:
1. Road Transport Sector: Low Carbon Vehicles – Electric Vehicles and Alternative Fuel Vehicles (cars, buses, bikes, vans, trucks, etc) which need enabling and underlying new technologies such as power electronics, batteries, lightweight materials, electric motors, vehicle design, aerodynamic modelling, sensing, infotainment, grid integration.
2. Air Transport Sector: Light Aircraft including Personal Flying Vehicles – Low Carbon Solutions including Electric Aircraft, which need similar enabling and underlying new technologies to (i).
3. Smart Mobility (End-End Journey Management) for all Transport modes, helping the seamless movement of people and goods to be more efficient through integrated ticketing and shared information systems with other forms of transport, including logistics.

The above cases have been selected as they are all areas which are rapidly growing and need high levels of innovation and offer great opportunities to SMES because they require new supply chain models.

To meet the abovementioned key aims, the project had the following operation objectives:

- Identification and analysis of barriers to exploiting innovations developed in EU R&D projects
- Development of guidelines for exploitation and dissemination plans to help project partners
- Identification of opportunities from new forms of transport
- Formation of Pan-European Innovation networks
- Study of the role of SMEs in Research and Innovation
- Conduct SWOT analysis on selected regions
- Recommendations to support innovation links for developing new transport products and services through pilots in selected MS regions
- Organisation of market opportunity workshops, Roadshows and SME Opportunity Workshops
- Organisation of a final policy event

Main results

EU R&D projects and market impact analysis

Identification of barriers to exploiting SME innovations developed in EU R&D projects

The key task was to examine the role and activities of SMEs in EU R&D Projects in Low Carbon Transport and Smart Mobility, the barriers they encounter and the strategies used to exploit their technology.

As INTRASME has been set up to help innovative SMEs enter supply chains, it was decided to limit the choice of projects to:

- Projects with high innovation potential with significant involvement of SMEs.
- Projects that are still on-going or recently completed where exploitation and dissemination support could still be helpful.
- Projects representative of different types of R&D Projects from different EC programmes and of the different challenges faced by SMEs.

A total of 168 projects were analysed to identify those with significant innovative SME involvement, either as an important partner supplying technology or in a few cases acting as project coordinator. A difficulty was encountered in identifying the status of some companies, as the CORDIS database does not identify SMEs. SMEs were identified using company websites or nationally available databases of registered businesses where possible.

The list was also filtered to ensure coverage of the 5 technology categories identified above, viz. Low Carbon (Land) Vehicles, Electric Aircraft, Electric water vehicles, Smart Mobility, Enabling technologies. This detailed project analysis resulted in a short-list of 56 projects. To decide which SMEs to interview, it was also agreed to focus, where possible, on Partner countries (and neighbouring countries) as for these SMEs there was the possibility of local knowledge and existing contacts as well as assistance in the interviews, making it more likely that SMEs would be encouraged to participate and provide information. Initially 38 SMEs were identified and targeted for interviews, including 4 SMEs acting as coordinators of EU projects.

Coordinators and other participants also involved in the projects and in exploiting the results, e.g. Original Equipment Manufacturers (OEMs), Tier 1s, Research Institutes were selected for interview to capture their views of SME involvement, taking advantage where possible of existing links with the INTRASME Partners which would make it more likely that they would wish to participate. Initially 25 Coordinators/other organisations that were not SMEs, but were involved in EU projects with SMEs, were identified and targeted to approach for interviews.

The SMEs short-listed for interviews were contacted by the Partners, and interviews were carried out either by personal visits or by telephone, using a structured questionnaire. A good response rate of about 55% was achieved with good coverage of EU countries. Only 2

companies refused to participate, others said they would be interested at a later stage due to work pressures and 3 had either been acquired by other companies or ceased trading. The 21 SMEs interviewed across the technology categories were involved in 31 EU R&D projects.

We also analysed the results of surveys of participants in R&D projects (SMEs, large organisations and research institutes) using a structured approach. It took account of the results of a survey of SMEs who did not participate in EU R&D funding (either through choice or through the barriers they encountered). These on occasion had participated in EU R&D programmes but more often had not participated in EU or national programmes or have participated in national programmes only. Both of these categories provided context for understanding the level and effectiveness of SME participation in EU R&D programmes.

The main barriers identified by SMEs involved in EU R&D projects to developing and exploiting their innovations, validated by coordinators and other non-SME organisations in such projects, are:

- Linking to Exploitation Partners – OEMs, Tier 1s/ Tier 2s etc
- Finance and Business Case (including Market Need)
- Innovation and Links to Universities/ Research Institutes
- Productionisation
- Need to join Clusters for Critical Mass
- Need to understand EC Programmes and Bid Processes and for Guidance and Support.

Potential solutions to overcome identified barriers were developed, shaping internal INTRASME project actions, and producing recommendations to the European Commission to make EU R&D programmes more accessible to SMEs and more effective at exploiting the innovations of SMEs. See below.

Overcoming Barriers to innovation for organisations in EU R&D projects, and guidelines for exploitation plans

The project compared the strategies implemented by organisations who were part of the EU R&D projects survey - with best practice for overcoming innovation barriers, identifying the extent to which organisations develop appropriate exploitation plans for innovations they develop in these projects. Furthermore, other areas which were observed were any key deficiencies in their exploitation plans, the overall project exploitation plans that may hinder them, and what actions can be taken to overcome such deficiencies and be best addressed (participant action or EC action such as adjustments to the support/ instrument mechanisms).

Specific exploitation and dissemination guidelines were produced, presenting options and potential solutions for successful exploitation of EU R&D project results. These guidelines are intended for the following groups, but many of the recommendations are equally relevant to the wider innovative SME community:

- Electric Vehicle (EV), Smart Mobility (SM) and associated technology SMEs
- Project Coordinators working with SMEs in their projects

The Guidelines Report only specifically addressed SMEs but included discussion of issues that Project Coordinators may wish to consider to maximise the value SMEs contribute to their projects. Following an examination of barriers encountered by SMEs in entering the

transport supply chain, this provides practical advice to overcome identified barriers specific to the EV/Smart Mobility sectors, this is based upon examples and case-studies from successful or pioneering SMEs.

The advantages and disadvantages of participation in EU R&D projects for SMEs have also been identified and a checklist was provided to assist SMEs decide if participation in collaborative R&D is appropriate for their business and its state of maturity. Guidelines have been developed for SMEs to enable them to maximise the value they could get from participating in EU R&D projects. It also allows them to identify how they could be exploiting their innovations developed in the projects. Examples of successful exploitation activities achieved by some SMEs in EU R&D projects have been described together with other SMEs who have experienced similar problems in fulfilling their exploitation expectations.

Development of support measures for SMEs

A number of support measures and proposed actions were identified. The INTRASME support mechanisms included:

- INTRASME tools and reports, available from the on-line support platform
    - Includes guidance to SMEs (and organisations working with them) to maximise the value they get from participating in EU R&D projects (Deliverable D1.1).
- INTRASME events, roadshows, Horizon 2020 briefings to SMEs, etc
- Exploitation of existing pan-European and regional support networks
- Cluster development to facilitate collaboration and support SME access to possible future funding, etc
- Collaboration with other EC projects, specifically the SMART EV-VC project (collaboration in dissemination activities) and TIPS project (collaboration in dissemination activities and using TIPS outputs in particular useful IP support materials for organisations including SMEs).
- Other mechanisms such as the publication of an SME Capability Brochure to aid networking, and dissemination of INTRASME exploitation guidelines for SMEs considering participation in EU R&D Programmes.

Recommendations to EC Policy Makers

To maximise their impact, further support to enable exploitation of SME innovations is required from the European Commission and national agencies. WP1 has identified potential solutions to overcome the SME innovation barriers (identified above) and it has made recommendations to the European Commission for their consideration. These recommendations, including new types of projects and contract instruments, are aimed at making EU R&I programmes more attractive to SMEs and assisting SMEs in taking their innovations to market. In some cases, changes to instruments and mechanisms made in Horizon 2020 (compared to Framework 7) will help to address these requirements.

A series of 11 recommendations in 4 categories were produced for consideration by the EC, these are listed below:

<u>EXPLOITATION OF PROJECT RESULTS</u>

1 – Financial Exploitation Partners
2 – Mid-way Review of Exploitation Plans
3 – EC support to potential exploiters of EC project ideas
4 – Follow-on projects to exploit the outcomes of successful projects

BROKERAGE & NETWORKING EVENTS
5 – Involve SMEs in Green Vehicle 'Concertation' (Project Coordinator) Workshops including completed projects

PROJECT INSTRUMENTS AND MECHANISMS
6 – Market data projects for SMEs
7 – Short feasibility studies by SMEs
8 – Future Emerging Technologies (FET) for SMEs
9 – Productionisation Projects

EU POLICIES TO SHAPE THE MARKET
10 – End-user incentives for EV customers.
11 – Shape EU EV policy around regional policy

Opportunities from new forms of transport

Our research identified the case of a changing value chain of the automotive industry. This is because the key components of the electric vehicles' powertrain are significantly different from that of an internal combustion engine. In many cases, mainstream automotive companies do not have the full internal technological knowhow for the electric vehicle powertrain. Therefore mainstream automotive companies are attempting to capture the value of the emerging EV value chain through the development of strategic partnerships, which includes SMEs. The consequences of this are that we found SMEs not only developing electric vehicle technology with mainstream automotive companies, *but without them as well*, and not only developing electric vehicle component technology, *but the full electric vehicle.* Furthermore we have found evidence of SMEs being supported from incumbent large companies coming from sectors outside the mainstream automotive sector. This is because these larger companies from other sectors see the opportunity of entering the electric vehicle sector (not only cars but in a broader definition), and they see SMEs ability to move faster as a more suitable strategy to make entry into this market.

Because of the technical characteristic of electric vehicles and their desired functionality within an integral energy system, such as smart grids, other industries will have to step into the automotive industry, namely the utility and ICT sectors. Concepts such as Smart mobility; which are driven by environmental, safety, quality of life and economic concerns, are pushing these synergies forward and at the same time opening great opportunities for new business models.

Overall this setting represents an opportunity window for SMEs that will not be open too long, so it is an opportunity for those SMEs that can build strategic relationships with larger organisations and other SMEs in order to capture most of the value of this changing industry. Those SMEs that move in a "fast and furious" paradigm will be able to succeed in building strategic relationships to either develop their products with mainstream automotive, ICT,

utility and other large companies, or even develop their own vehicles with the other SMEs. Whilst this situation showcases an optimistic scenario for SMEs, their survival will ultimately depend on the electric car industry taking off and rapidly growing, if this is the only electric vehicle market targeted. This is why diversification proves to be an element of success.

Some SME cases were found to prefer to diversify in different types of electric vehicles, even where the development of electric passenger cars is regarded as the ultimate priority. SMEs developing electric passenger cars are seeking to brake with design and production paradigms of the mainstream automotive sector through targeting niche markets such as urban mobility segments with Light Electric Vehicles. Those SMEs working in water and light electric aircraft sector enjoy of the benefits of working in niche markets.

We analysed the relevance of brake energy recovery and light weight design in urban driving cycles. We examined the impact of weight reduction on battery size as a strategy for total cost of ownership reduction, whilst keeping the same range extension. This analysis showed the opportunity for development of lightweight materials. The technological requirements, challenges and opportunities for the development of future autonomous vehicles, which are key for the development of the Smart Mobility concept, were identified. Car Sharing was presented as an entirely new business model.

The mainstream automotive industry has remained firmly entrenched in the ‘business as usual’ for the development of electric vehicles based on incremental steps in manufacturing philosophies, gradually moving from an ICE to an electric car. This is mostly reflected in the size and weight of the electric cars developed by these companies, which are the same of the current ICE. This is mostly related with the flexibility to manufacture both ICE and electric vehicles in the same manufacturing lines. This is a safer option for mainstream car manufacturers given the large amount of assets invested in current automotive manufacturing plants.

It would appear that mainstream vehicle manufacturers have invested a great deal of effort into making EV purchase and ownership propositions more aligned to that of conventional ICE cars, albeit with mixed success and degrees of separation from the established business model. Indeed, the industry has demonstrated an impressive ability to resist change.

During the transition from an ICE to an EV industry, there is a window of opportunity for new entrants to capture value of the new electric vehicle industry. It is not clear yet who will capture most of the value and growth opportunities, but the race is certainly between mainstream car makers, incumbents and new entrants. Among those new entrants are semiconductor, power electronics companies and even agricultural machine manufacturers these companies are aware of the opportunity and are capturing value down in the supply chain, in many cases through supporting fast moving SMEs. This the case for other industries that are being compelled to integrate to the electric vehicle industry such as such as energy utilities and ICT companies, these companies are also trying to capture value through SMEs.

From the mainstream automotive manufacturers perspective, they will focus on taking advantage of the powertrain evolution so it is crucial for them to achieve the right component portfolio – capture growth opportunities, manage market decreases, and hedge against technological uncertainties. This is a trillion dollar market, so they can’t get it wrong!

We have broadened the scope of electric vehicles beyond cars, to expand to electric vehicles in land, sea and air. Since many electric vehicle technologies are transversal to all the different types of vehicles, the developments made in one market can be translated to the other. Through this we have showcased those niche markets in which many existing SMEs can engage as a diversification strategy, in the meantime the electric car markets emerges. Many current SMEs are already successfully marketing their products within this market. The market forecasts of these segments were developed as part of D2.1 and are presented below;

The main forecasts are presented below

Year	Hybrid K	% hybrid plug-in	Number hybrid plug-in K	Pure electric Quad	Pure electric mainstream car	Total plug-in car whether hybrid or pure electric	Total electric car whether hybrid or pure electric
2012	1522	2.3	35	115	65	215	1702
2013	2005	5	100	216	70	386	2291
2014	2403	6	144	328	77	549	2808
2015	2845	7	199	524	86	809	3455
2016	3445	8	276	700	100	1076	4245
2017	4105	9	369	900	120	1389	5125
2018	4846	10	485	1155	150	1790	6151
2019	5655	20	1131	1400	190	2721	7245
2020	6849	30	2055	1800	300	4155	8949

Table 1: Forecast Electric Cars 2012-2012 in thousands of units

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Heavy industrial "TOYOTA" type	453 (99)	507 (99)	560 (99)	621 (98)	703 (98)	763 (98)	815 (97)	867 (97)	923 (96)
Buses	22.2 (51)	26.2 (55)	31.2 (62)	37.3 (72)	46.6 (80)	58.2 (85)	72.9 (88)	91.1 (89)	113.8 (90)
Light industrial/ commercial and trucks	262.9 (88)	270.8 (88)	281.6 (89)	295.7 (89)	320.5 (89)	333 (90)	342.3 (90)	359 (90)	377 (90)
Mobility for the disabled	1,300 (100)	1,450 (100)	1,600 (100)	1,800 (100)	2,050 (100)	2,300 (100)	2,450 (100)	2,600 (100)	2,750 (100)
Two-wheel and allied	34,000 (100)	38,000 (100)	43,000 (100)	49,000 (100)	56,000 (100)	64,000 (100)	73,000 (100)	83,000 (100)	94,000 (100)
Quadricycle / Micro EV	115 (100)	216 (100)	328 (100)	524 (100)	700 (100)	900 (100)	1155 (100)	1370 (100)	1650 (100)
Mainstream Car hybrid	1522 (0)	2005 (0)	2403 (0)	2845 (0)	3445 (0)	4105 (0)	4846 (0)	5655 (0)	6849 (0)
Mainstream car pure electric	65 (100)	70 (100)	77 (100)	86 (100)	100 (100)	120 (100)	150 (100)	220 (100)	450 (100)
Golf car and	265	265	265	265	265	265	265	270	271

motorised golf caddy	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)
Military	22.6 (82)	25 (82)	26.5 (82)	30.2 (82)	35.4 (82)	41.4 (82)	48.8 (82)	59 (80)	70 (78)
Other	1,671 (99)	1,803 (99)	1,955 (99)	2,118 (99)	2,291 (99)	2,474 (99)	2,677 (99)	2,891 (99)	3,105 (99)
Total rounded	39,700	44,600	50,500	57,622	66,000	75,400	85,800	97,400	110,600

Table 2: Global Forecast Land Electric Vehicles 2012-2020 in thousands of units and (% of pure electric).

Forecast for Pure and Hybrid Electric Air Vehicles

Electric aircraft are at a too early stage for detailed forecasting to be meaningful. Several hundred conventional Boeing aircraft are being converted to become electric vehicles when on the ground, saving millions of dollars and reducing air and noise pollution thanks to an electric nosewheel. That involves a SME in Gibraltar, Europe, and it should rise to thousands of large aircraft being converted or manufactured to have this capability by 2020.

There is already an identified market for electric powertrains in hang gliders and light electric aircraft – mainly micro-light sailplanes. Suppliers include Pipistrel in Slovenia and PC Aero and Lange Aviation in Germany – all of which are SMEs. Perhaps 10,000 will be sold worldwide by 2020. What is more uncertain is whether the conversion of the best-selling Cessna light aircraft to pure electric will result in significant new business. Meanwhile, the market for military aircraft such as the Northrop Grumman $517 million unmanned surveillance airship cancelled in 2013 is more substantial and consists of thousands of hand launched surveillance aircraft sold in the USA each year and large value contracts for developing surveillance bats, swarming flies and the like are being placed. However, most of the supply and demand for this is in the USA.

Europe is assisting with this activity, through a Boeing contract which aims to develop a fixed wing unmanned aircraft stay aloft for five years based on energy harnessed from the sun. Newcastle University (UK) is developing the ultra-lightweight motors and QuinetiQ (UK) is working on the development of the airframe. In Europe, the FlyNano a flying jet ski which is pure electric and the hybrid Equator aircraft of Norway are examples of very different light aircraft, there is also development work on hybrid electric drones that could take off and land silently in an all-electric mode. It is impossible to say which will succeed but the global market for hybrid and pure electric air vehicles is of the order of 10 Million €, 100% pure electric, in 2013 with the numbers in tens. It is probably set for Euros 1 billion, 50% pure electric, in 2013, with the numbers in hundreds at a higher unit price as they get bigger, whilst there is a focus towards the military but excluding airliner electric nosewheels.

Forecast for Pure and Hybrid Electric Water Vehicles

As with aircraft, most of the first commercial electric aircraft are pure electric with larger but hybrid versions for tougher duty cycles being added later, increasing average unit price. Hybrid tugboats are predicted to reach high volumes, partly driven by harbour pollution

regulations and by better performance, whether hybrid or pure electric. Kongsberg of Europe is a leader in Autonomous Underwater Vehicles AUVs, all of which are pure electric, and global annual demand being of the order of one thousand at high prices. The highest volumes come from small surface boats for leisure and used on inland waterways, Ruban Bleu (an SME) in France is one of the suppliers. In the USA fishing on inland waterways is popular with dinghies powered by near-silent electric outboard motors.

Note: (% pure electric)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Marine	71 (98)	73 (97)	75 (96)	78 (95)	81 (94)	84 (93)	87 (92)	91 (91)	95 (90)

Table 3: Numbers of electric marine craft, in thousands, sold globally, 2012-2020

Case Studies

Examples of SMEs developing electric vehicles and related technology were analysed. This included not only which kind of electric vehicles and/or related technologies these companies are developing but disclose how these SMEs have developed their technologies as well as the financial, research and development resources that they are employing. Their commercialisation strategy or their intention to commercialise their products was presented. Aspects of their strategies to position themselves in the electric vehicle supply chain are also showcased. The selection process for the case study sample is informed by different technical and business success factors, opportunities for business growth, diversification and integration strategies.

The SME case studies described indicates a wide range of experiences from SMEs in the Smart Mobility sector drawn from UK, Germany, Poland and Italy. Many of these SMEs can be considered to exist at the micro-SME size scale and all have been brought into operation by a small number of founding individuals who have a clear and focused view on how a company could be formed to develop a niche service and a profitable business.

Developing a reputation, and supporting initial product or service R&D is a common theme in the early stages of forming a viable company and may require external support in the form of alliances, collaboration and potentially external funding. Growing beyond launch and establishment phase requires a developing market place and potentially the acquisition of new skills and/or business integration. To the extent that these SMEs are still in the early growth stages, indicate the difficulties that exist between converting good ideas, technologies and concepts into a growing business.

The cases attributed to the Smart Mobility sector illustrate the diverse nature of the form of organisations that may contribute to shaping of elements in the future of Smart Mobility services in the future from the SME community. Some of these companies may be producers of products and services that may be more traditionally identified as being within a “different” industrial sector, e.g. ICT, electronics, automotive etc, but have migrated by choice or chance into a field that is described as Smart Mobility. The range of companies described in the case studies represents a range of sizes from 3 to 103 employees with the

majority employing less than 25 employees. In this respect the case study companies are currently at a micro-SME level. This is also reflected in the age of the companies with many being established within the last ten years and hence could be considered to still trying to establish their position in the market. It is also unsurprising that many companies define themselves more closely aligned to a local/regional or national market for their specific services.

Formation of Pan-European Innovation networks

Having considered the factors affecting the innovation capabilities of INTRASME target regions with particular attention to the low carbon transportation sectors, the project designed and developed a set of on-line and off-line tools and activities which aimed at filling in the innovation gaps highlighted by the regional analysis.

Through a set of networking actions INTRASME brought the creation of a cluster of heterogeneous EU Regions in which SMEs and research centres collaborate to define quicker and sustainable routes to market. An easy-to-use interactive web-based Innovation Network Support Platform and Best Practice Toolbox backed up the "clustering action" mentioned above.

The development of the easy-to-use, interactive and engaging Innovation Network Support Platform has been based on the User Requirement Document, and the System Requirement Document where INTRASME partners identified key business needs that the project had to address through the INTRASME online support platform (with best practice toolbox) and several off-line activities that have been carried out.

Key barriers identified by the project are: Access to finance/capital; Access to information; Access to tenders and co-funded R&D programmes; Human resources; Market; Marketing & Commercialization - includes linking to exploitation partners; Networking - to help SMEs achieve critical mass; Partnership - includes encouraging SME-Research Institute cooperation and EU Technology Transfer; Patents and intellectual property; Technology.

The INTRASME partners identified the potential users of the platform and its tools:

- ✓ European Companies;
- ✓ Regional Clusters;
- ✓ Exploitation partners: R&D institutes, Universities, Large Companies, etc.
- ✓ Intermediaries: business support organizations, experts, international networks, etc

The Innovation Networks Platform and the Best Practice Toolbox have been embedded in the project website, so as to integrate the public information available there with a specialized section reserved to registered users only: http://intrasme.eu/index.php/innovation-networks-platform. Structured around four main areas, the platform presents these features:

1. Best Practice ToolBox & Knowledge Repository
2. Networking & Partnership Development
3. Thematic Fora
4. INTRASME Case Studies

In all of these sections partners highlighted the different technologies, dedicating specific forum for each category and adding filters allowing the research of partners and case studies by technology and sector. Here is one of the main differences between online and offline activities: while the platform tried to valorise the technological differences, the offline activities have been based on geographical criteria, highlighting the transversality of EV and SM technologies.

Despite the platform has been designed as a mix of static and dynamic sections, the platform has proved to be more successful and relevant for its repository of Best Practice Toolbox and Case Studies, while the four Thematic Fora and the Networking and Partnership development area didn't register particular interest from the registered users.

While the platform has been developed to answer transversal needs, tackling common issues, the offline activities aimed at responding key regional issues, including every time an international dimension trying to foster the two levels of INTRASME networks:

- regional level, involving local stakeholders
- international level, mobilizing actors with relevant sectorial specialization and expertise

The prime purpose of INTRASME regional roadshows is to raise awareness among SMEs of the opportunities offered by the EV and Smart Mobility industries, including participation in EU funded programmes. Regional roadshows, particularly for certain regions, represented the opportunity to raise awareness about the LEV (light electric vehicle) and Smart Mobility Sectors among public administration and possible exploitation partners.

INTRASME activities carried out during the first year of the project lifetime provided the major input to the structure, direction and focus of the roadshows both in terms of research results and opportunities for SME involvement: indeed several companies, and their products and services, have been presented as case study examples within the project to evidence the range of activity achievable by SMEs.

Built upon mentoring and networking elements, regional roadshows have actively promoted INTRASME goals and brand within EU target regions and allowed partners to touch base, at the "grass-roots level", by working directly with regional actors of the EV and SM value chains.

Knowledge of the Electro mobility and Smart mobility potential is still limited and often misused. The INTRASME project stressed the importance of promoting low carbon transportation related technologies to stakeholders (SMEs, start-ups, students, corporate federations, large groups, etc.), to show how technology based solutions can be applied to solve and/or implement solutions and goes further to identify which applications are already in operation.

Moreover, organising roadshows at a regional level has been a very effective outreach mechanism to many companies and due in-part to the direct involvement of the regional stakeholders such as chambers of commerce, municipal governments and of course SMEs they could be representative of both embryonic and already established regional clusters – depending on the maturity of the innovation linkages within the regions.

Therefore between February and September 2014 six roadshows have been organized and carried out in Poland, UK, Bulgaria and Italy to build regional and trans-regional informal networks for innovation.

When developing the roadshows concept INTRASME partners decided not to focus each event on a specific technology as there are many technology typologies that reflect different specific sectors in the identified regions. This choice responds to SMEs indicated preference to diversify in different types of electric vehicles, even where the development of electric passenger cars is regarded as the ultimate priority, targeting niche markets such as urban mobility segments with Light Electric Vehicles (see INTRASME Case Studies).

INTRASME regional roadshows aimed to show SMEs how to build strategic relationships to either develop products with mainstream automotive, ICT, utility and other large companies, or even develop their own vehicles with the other SMEs – as can be seen by recent 'independent' manufacturers of vehicles. Moreover the project aimed at kicking off these collaborations between SMEs as they now have the opportunity to take advantage of these changes in the automotive industry.

In addition to these technological considerations, INTRASME partners customized the objectives and activities outlining the roadshows' generic concept according to specific requirements and identified needs of expected attendees and target audience of each region. Results from SME interviews, regional SWOT analysis and regional focus groups orientated the definition and development of the roadshows and therefore the selection of presenters and case studies matching the identified needs.

In general, consortium partners invited representatives of business and industrial sectors, science and R&D institutes, universities, academics, business support organizations, public administrations, clusters, IP and patents experts, etc. to provide roadshows participants with a wide picture of the regional context and potential exploitation partners and/or stakeholders.

The international dimension has been entrusted to project partners and associate partners presenting INTRASME regional context and relevant case studies. In regards to the latter, the consortium identified companies that reflected a wider typology of technologies and different sectors so to better reflect the transversality and the different opportunities offered by the LEV and Smart Mobility sectors. Where possible, non-regional companies have been invited to personally present their product and services. Sharing the experience of these participants broadened the horizon of the roadshow participants and emphasised the international dimension and facilitated the creation of links between regions through discussions as part of the networking element of the roadshows.

INTRASME online platform: lessons learned

The platform has served the main scope of providing concrete examples of what European SMEs are doing in the electro mobility and smart mobility sectors. In addition, the online platform allowed the project to go well beyond the "INTRASME borders", accessing information and reaching out stakeholders outside the partner regions (i.e. Portugal, Greece, Germany, Netherlands, Serbia, etc.).

Even if partners supporting foresaw room for online exchange and interaction, the consortium noticed that the four thematic fora and the networking and partnership development area have not been exploited as expected. Having discussed this with companies and other potential users they explained that **more direct ways are preferred (i.e. social media) for first exchanges.**

Partners actually noticed that the project LinkedIn group (approximately 50 members) and the Twitter profile (with more than 140 followers) served as active extensions of the online Innovation Network Platform. Nevertheless the online platform provided a reference point for companies and stakeholders looking for tips and concrete solutions on how to best approach these niche markets and enter them quickly and efficiently.

INTRASME Roadshows: lessons learned

The INTRASME regional roadshows proved to be an effective means to reach SMEs and potential exploitation partners in the LEV and Smart Mobility sectors.

The significant attendance at the six roadshows showed the need for this kind of event in the target regions, and particularly for Poland and Bulgaria. The novelty of these sectors, the need for funding opportunities, and the difficulties SMEs meet in accessing the LEV and Smart Mobility markets found a first reply in these sectoral events, addressing the needs emerged from the interviews and the analysis carried out in the initial part of the project.

The tailored approach was highly appreciated by roadshow participants. Looking at the six different events we can clearly notice that Polish and Bulgarian companies were particularly interested in networking opportunities with other companies and potential exploitation partners and getting a general understanding of R&D funding opportunities available at national and European level, while Italian companies in Turin and Milan were more interested in obtaining a clear understanding of "winning strategies" to apply to Horizon 2020 calls, and UK ones were particularly attentive to the regional mechanisms supporting their business and technology development.

Even if built on a common model, each event achieved different results, involving different stakeholders and addressing different priorities.

INTRASME Innovation Networks Success Stories

INTRASME Innovation Networks related activities had clear impact on the "between regions" dimension and in the new members state region.

The first result is represented by the intense discussions carried out across Europe on the role of SME clusters in the electro mobility and smart mobility sectors.

There is a strong realisation that no-one geographic area is likely to be able to provide all the inputs needed for collective success. Each region has its own unique mix of history, culture, resources, institutions and strengths on which it can build. Weaknesses can be counteracted by opportunities in collaborating with others who have complementary strengths. Threats can be countered through mutually beneficial collaboration rather than unproductive competition. The new electro and smart mobility clusters need to be based in a philosophy and strategy of smart specialisation – that is focusing on existing strengths but collaborating with other

clusters working in the same area and with complementary strengths. In doing so it should be possible to promote superclusters which operate at an EU level and can compete globally in a way which individual clusters cannot.

Through the INTRASME Innovation Network activities, an embryonic supercluster has been shaped and initiated involving Torino e-District, Warszawa e-Mobil cluster and the Proving Factory. The discussion around this initiative attracted a lot of interest from other clusters across Europe highlighting the need to test this tool as a key element for the low carbon transportation market uptake of European SMEs.

The second success story, confirmed the efficiency of INTRASME innovation networks, particularly in those regions with weaker innovation linkages. The networking actions undertaken in Ruse (Bulgaria) proved to be successful not only within the region, where several stakeholders have been activated, but outside too and particularly with Romania.

Due to its geographical position, INTRASME partners selected Ruse region to provide support in further improving the collaboration with Romanian stakeholders in the fields of electro mobility and smart mobility: indeed the proximity to the capital city of Bucharest and the cross-regional programmes already in place between the two countries, represented great opportunities for the low carbon transportation and smart mobility Bulgarian sectors.

When organizing the Bulgarian roadshow, the strategic regional context has been valorised, involving and working closely with local partners from both sides of Danube river: BAEPS and Ruse Chamber of Commerce and Industry (EU-BIC unit) in Bulgaria, and ICPE, the e-mobility Romanian cluster now re-named *go.electric*.

Partners prepared the ground since the early stage of the project inviting both Bulgarian and Romanian associate partners to attend several INTRASME workshops and roadshows: Ruse CCI, BAEPS and ICPE attended previous events and had the chance to test and evaluate what could work best during the Ruse roadshow.

As stated by the regional partners and the roadshow participants, the networking and mentoring activities reinforced the ongoing cross border transport related projects and activities between Bulgaria and Romania – particularly involving Ruse, Bucharest and Giurgiu. The event brought together several actors from both side of the Danube River, who got to know each other and exchange in person about possible collaborations. Also in this case, high appreciation has been showed by regional/sectorial clusters who expressed their interest in enhancing cross border cluster collaborations.

INTRASME Innovation Network pilot results

INTRASME partners have developed tools and actions to provide European SMEs with the opportunity of getting in touch with other actors of the innovation chain within their regions and –whether possible- in other regions also to effectively exploit their ideas.

From initial project analysis, SMEs (especially micro-SMEs) sometimes require support from larger networks to give them access to tools and knowledge they need but do not have the resources to acquire: the INTRASME roadshows responded particularly well in addressing these needs and have provided SMEs with networking opportunities to develop collaborative relationships within the innovation value chain.

The Online Innovation Networks Platform now has more than 50 subscribers from SMEs, universities and business support organizations, showing the growing interest of the innovation chain stakeholders in opportunities in the electro-mobility and smart mobility sectors. This interest has been cultivated through online campaigns (INTRASME website, emails), and during INTRASME events, particularly the project opportunity workshops and the regional roadshows. The online platform has been designed as the natural environment wherein to continue the conversations and the networking started during those meetings.

"Offline", INTRASME piloted the Innovation Networks in the partner regions, where this kind of event proved to be a very effective outreach mechanism to many companies and representatives of clusters, due in-part to the direct involvement of the regional stakeholders such as chambers of commerce, municipal governments and universities. Different techniques and tools have been tested and used in the different contexts to facilitate networking. Where possible, an exhibition area was made available and regional/European services available to SMEs were presented complemented by SMEs products and services to demonstrate how these can be applied.

Working closely with local partners in the four partner regions, allowed the project to deliver customized events based on the specific requirements of each region. Moreover, INTRASME partners, whenever possible have activated an extended network of electro and smart mobility stakeholders, to further stress the international vocation of the project: European projects, representative of large OEMs, international experts, European networks, etc.

Therefore we can conclude that the role of Pan European Innovation Networks is absolutely relevant to support European SMEs entering the electro mobility and Smart Mobility sectors. Mentoring and networking activities would help companies to better understand the market and its players, and position themselves among them.

As INTRASME considers the collaborative approach between and within region a key element for the success of European SMEs, further actions and resources should be invested in order to strength and spread this networking approach piloted in the 4 partner regions, having proved to be effective for the regional and European low carbon transportation ecosystems.

Innovation mechanisms

A key aim of the project is to improve the capacity and capability of European SMEs to rapidly develop and implement products in the low carbon transportation sector. This allowed the project to determine the principal challenges for SMEs when developing technologies, the motivations adopted for driving the strategic direction of the business and how SMEs have overcome the barriers encountered as part of this process. A total of 57 in-depth interviews took place with SMEs from the target regions of West Midlands, UK, Piedmont, Italy, Poland, Warsaw, Ruse, Bulgaria and other EU regions also.

SMEs interviewed were predominantly active in LCV & SM industries as there were recognised opportunities to develop market share. Many had personal interests (technology development / application) within this industry sector and produce technologies appropriate to the LCV sector which is perceived as an 'open market' where technologies could easily be established. Initial observations identified that whilst micro-SMEs associated with the light electric aircraft had a personal interest and involvement with the industry. Whereas electric land vehicle SMEs were invariably younger firms (<20 years old) and alluded to an environmental philosophy and belief that the sector would experience rapid growth. Smart mobility SMEs were often guided into the industry by a background in electronics/ICT and collaboration with a lead commercial partner.

The predominant source of technology acquisition is sourced from management and in-house R&D as principle sources, followed by partners, regional clusters market trends and lastly commercial partners. This clearly identifies the importance of entrepreneurs who are the anchor point for new technology, products and/or services developed with SMEs. However, there is a difference even within this area, as micro businesses draw on regional know-how and that of partners whereas medium sized business are more likely to develop products based on market trends and to a certain extent sales volumes of products. This market readiness, ability to change direction to market needs / trends demonstrates flexibility of the business.

SMEs are active in collaborating in product development with a number of external organisations such as universities, large companies and other SMEs within the local area, this suggest that academia plays an active role with industry.

During the course of gathering data from SMEs, there were a number of identified barriers which SMEs felt were a hindrance to developing products within this sector, the principle barrier identified is that of finance. A wide-scale issue for SMEs is moving from a prototype of low volume production to large-scale production. Whilst efforts are made to source supply chain partners this often proves difficult due to the required investment required in a growing and emerging sector.

Within low carbon transport and smart mobility sectors, an assessment to identify and analyse the barriers SMEs face in exploiting their innovations was completed. These findings have been validated by coordinators of EU R&D projects and other non-SME organisations, the main findings within this area are;

- Linking to Exploitation Partners – OEMs, Tier 1s/ Tier 2s etc
- Finance and Business Case (including Market Need)
- Innovation and Links to Universities/ Research Institutes
- Productionisation
- Identified need to join Clusters for Critical Mass
- Need to understand EC Programmes and Bid Processes and for Guidance and Support

Specific analysis indicated that 12% of micro SMEs and 33% of SMEs are active in EU R&D programmes; this figure increases significantly to 28% for micro-SMEs that are involved in National R&D Programmes. The involvement of SMEs in R&D programmes is also influenced by geographical location.

There are some clear indications as to the reasons for non-involvement of SMEs in EU R&D projects; whilst bureaucracy may be the most frequently indicated reason, other elements which also identify potential mechanisms of support are regulatory barriers, a time consuming process – application to approval/rejection, and lack of awareness. As an example recommendation to overcome this would be the active involvement of SMEs in activities undertaken by the EC such as SME involvement in the Green Car Concertation Workshops and for INTRASME to propose how this would be effectively implemented in the future.

This activity has also produced a number of recommendations that could encourage the active participation of SMEs in EU R&D Programmes by identifying a number of mechanisms that could be implemented at policy level as well as regional level. These mechanisms are identified as key actions strengthening the potential collaborative relationships within the context of EU R&D programmes.

These 5 key areas that could be boost and strengthen the ERA;

- Effectiveness of National Research Systems – including increased competition within national borders and sustained or greater investment in research
- Transnational Cooperation – defining and implementing common research agendas on grand-challenges, raising quality through Europe-wide open competition, and constructing and running effective key research infrastructures on a pan-European basis
- Open Labour Market for Researchers – to ensure the removal of barriers to research mobility, training and attractive careers
- Gender Equality and Mainstreaming in Research – to end the waste of talent which we cannot afford – to diversify views and approaches in research and foster excellence
- Optimal Circulation and Transfer of Scientific Knowledge - to guarantee access to, and uptake of, knowledge by all.

The INTRASME project identified and linked proposed mechanisms to encourage SMEs to be more active in R&D programmes, a summary of some key mechanisms are below;

- Supporting SMEs accessing co-funded R&D programmes – particular needs have been expressed to improving access to information, simplifying access to funding

programmes, reporting procedures, technical support in project application, improve the timing of approval of projects, providing more weighting to SMEs.

- Exploitation of R&D project results – an awareness raising action for financial partners that could be considered as exploitation partners and the key role that they could play when considering the second stage of development from concept/prototype to production/market readiness. EC to emphasise the importance of exploitation plans and to possibly establish specific reviews at the mid-way point of a project.
- Market Implications of R&D project results – market data projects for SMEs have had a positive effect in the UK and there are examples of the Technology Strategy Board (UK) that have allowed the SMEs to better understand the global market. EU EV policy must be shaped around regional policy and coordinated with national governments; for emerging EV producers the vitality of regional clusters is important for sharing knowledge and resources and finding launch customers. The inclusion of end-user incentives for EV customers could be supported at the EU level.
- Productionisation - The EC should consider supporting projects to show that novel ideas are production ready, and possibly establish appropriate mechanisms that could support help manufacture successful prototypes.
- Recommendations to regional policy makers - the development of non-commercial clusters within regions will strengthen the collaboration between academia and private industry. This will enhance the exchange of know-how as well as promoting a flexible approach to end customers of the product offering. Furthermore, it may be possible to incentivise the use of public procurement as a tool to encourage local suppliers to develop consortia and overcome the early production development stage, the large contract/procurement levels often reduce the opportunity for SMEs to compete.
- Engagement with Academia – Stimulating the engagement/collaboration of universities with businesses and local communities, SMEs, in particular, need help in connecting with regional sources of R&D and technology expertise.

Innovation initiatives and linkages with Regions of new Member States

In the context of INTRASME, the analyses of each regional innovation system lead to the elaboration and proposal of both regional and cross-regional policy initiatives and recommendations. The SWOT analysis aimed to present a detailed characterisation of each INTRASME target region to establish a common work base, to identify different needs and skills, and highlight solutions already available in a region as possible best practices for other regions.

Regional data was collected through Business Incubation Centres (BICs) and experts located in INTRASME 3 partners Region: Warsaw (Poland), West Midlands (UK), Piedmont (Italy), and an additional pilot region Ruse (Bulgaria). Regional SMEs were identified and interviewed by regional BICs and experts, and data on SME decisions, actions and experiences were captured in a single, semi-structured questionnaire. On the basis of these interviews and additional desk-based work, the BICs gathered relevant information and data at regional and national level, and organised them into regional SWOT analysis reports. Regional SWOT reports produced by the BICs and the experts have been analysed and cross-checked by INTRASME project partners.

Moreover, in order to get a good example, a recognised innovative country in the EU--Finland has also been selected and involved as well. Finland offers interesting lessons in terms of innovation policies and, in the context of the low carbon transportation and Smart Mobility sectors, important and path finding National programmes have been developed which represent interesting benchmark opportunities for the INTRASME partner regions.

INTRASME partners proceeded to identify similarities and differences among the regions: similarities of the overall innovation framework, common weaknesses, common priority areas and emerging trends, etc. A set of regional recommendations were then developed and main actions following from gaps and opportunities identified within and between the regions. From regional priorities and recommendations, a number of overall recommendations have been produced. However, these will need to be implemented and adapted to fit the particular contexts of each region.

Overall recommendations for development of regional specialisation:
Stimulate active cooperation between universities, research institutes and SMEs:
The lack of active cooperation between businesses and R&D centres is a major weakness of the innovation system in many regions. For example, many Bulgarian universities and R&D centres see the EV and SM sectors as promising and reorganised their activities accordingly, thus giving them the potential to establish closer connection with Bulgarian SMEs and commercialise some of their developments. Given the low level of innovation of Bulgarian SMEs, collaboration with R&D centres would, in turn, give them the chance to develop innovative products and services.

SMEs need to develop their potential in respect to e-architecture, thermal management, weight reduction, testing, recycling, novel vehicle concepts, vehicle manufacturing systems, vehicle design and simulation, infrastructure and interfacing. All these areas could benefit from regional, national and international cooperation with R&D institutes, universities and other companies. Policy measures aimed at promoting public-private knowledge transfer or spin-offs are needed. Specialised inter-sectorial mobility programmes should be encouraged to allow the mobility of research staff between the public and private sectors.

Promote regional clusters:
Regional thematic clusters and associations such as ICEV and BAEPS in Bulgaria have the potential to provide effective support for research and innovation. In the West Midlands the strong regional research network, involving five leading universities, with three major research programmes of the Universities of Warwick, Birmingham and Coventry, together with MIRA, the CABLED programme and the Niche Vehicle Network, needs improved coordination, facilitating cross-fertilisation between the different schemes. This, together with other stakeholders such as CENEX could form the basis of a regional cluster. Involvement of SMEs should be encouraged and collaboration with universities and larger companies should be promoted to further develop and pull-through enabling technologies. A regional cluster could improve awareness, and stimulate and strengthen collaborative research and local production by SMEs in conjunction with larger companies: a pilot is recommended on development of small personal mobility vehicles. R&D collaboration could focus on development and manufacturing of batteries and other key technologies such as embedded systems.

Promote superclusters:

Cooperation programmes with international clusters can present good benchmarking and best practice exchange opportunities. Actions should be taken to promote collaboration between EU regions for which the development of EVs and SMEs is an opportunity to start local production independently from the constraints related to the ICE and its associated supply chain. ICT and system integration play a crucial role in the next generation of much smarter e-vehicles; European suppliers have the necessary technologies, but to sustain a European manufacture of e- vehicles it seems essential to pursue the development of a European supply chain and advanced R&D activities by focusing in few selected specialised regions.

For example, as pointed out in the 2013 EC report Research and Innovation Performance in Italy, cluster policy has been in place in Italy since the 1990s. At present, several clusters and technological platforms have been launched in Piedmont in high-tech sectors, such as aerospace, infomobility, renewable energies and electromobility. Further progress in promoting the involvement of SMEs in these sectorial clusters would derive from closer collaboration with other European clusters.

Stimulate national and regional markets:
The EC and individual member states should attempt to convince the public that EVs are the right solution for sustainable transportation, to guide SMEs and start- ups involved in developing and producing EVs and their components, to encourage private and public investment to flow into this field. For example, the high prices of EVs compared to the low incomes of Bulgarian consumers constitute a major barrier to the development of an internal market for low carbon transport. Significant incentives and subsidies are needed to stimulate internal market demand.

Governments have a role to play in ensuring that incentive schemes are actively promoted and guaranteed for periods long enough to provide a significant degree of certainty for buyers. In addition public procurement can be used to promote smart innovation. As major procurers of vehicles, governments should do more to drive demand for EVs by using buying standards which promote the EV market.

Promote strategies which exploit specific regional contexts:
Each of the four regions discussed so far have distinct characteristics, strengths and opportunities. For example, Ruse should explore the potential of the Danube River for the development of electric water transport. Moreover, the Ruse region should further improve the collaboration with Romanian stakeholders in the fields of electromobility and smart mobility. The proximity to the capital city of Bucharest and the cross-regional programmes already in place between the two countries represent great opportunities for the low carbon transportation and smart mobility sectors.

Think globally, act regionally:
A global approach needs to be undertaken by regional decision makers and stakeholders, embracing environmental and transport policies, research programmes, SMEs competitiveness and innovation policies. For example, the EC Report Research and Innovation Performance in Bulgaria 2013 pointed out that the (Bulgarian) EV market is focused on exports mainly through the emphasis on medium-tech products. In the case of smaller countries with less developed industries the development of an effective EU wide standards system is seen as being particularly important in allowing their domestic industries access a much larger market. Whilst there is a danger that standards development processes will be “captured” by the larger players to promote their own needs, a lack of standards will

inhibit market access. The call for development of standards is accompanied by the need to develop testing and certification facilities, with a frequent pleas that they be provided free of charge to users or access to be provided as part of regional mechanisms.

Simplify access to EU funding and participation in projects:
All regional SMEs face a lack of finance to support new projects and pull-through innovative ideas to commercial products. However, accessing funding schemes at both national and European level is seen as being prohibitively time-consuming and typical research projects often do not fit the timelines of SMEs for embedding innovative and technological developments in their products. Simplified instruments and local support mechanisms should be developed to facilitate the involvement of SMEs.

For example, Bulgarian SMEs remain reluctant to participate in R&D public programmes (both at regional, national and EU level) due to bureaucracy, time consuming and complicated procedures and lack of information. Measures need to be undertaken to simplify access to programmes/tenders and the procedures of management and reporting; to receive technical assistance in the preparation of project applications; to foresee assessment parameters that take more into consideration the features of SMEs and of small enterprises, identifying for instance smaller projects for them; to improve the timing of approval of projects and disbursement of resources.

In line with the EU "Smart Specialization" strategy, the study identified characteristics and assets of regions, highlighting each region's competitive advantages in the low carbon transportation and smart mobility sectors, and ways of rallying regional stakeholders and resources around an excellence-driven vision of their future. Moreover, the SWOT analysis can support the creation of Pan-European Innovation Network, responding to a "clustering need" of the low carbon transportation sector, in line with the Guide to Research and Innovation Strategies for Smart Specialisations (RIS 3)

INTRASME focuses on both regions and industry sectors, that is low carbon (particularly electric) vehicles and smart mobility. The regions have been chosen mainly because they are home to existing or developing clusters in the focus industries. However it is important to keep in mind that clusters and regions do not automatically overlap, although economic policies will frequently be aimed at cementing clusters within particular regions.

"Cluster glue", that is the essential element which binds clusters together, it can occur in a number of forms. It could be the cooperative activities of a cluster organisation, (funded) projects or programmes can also work. INTRASME proposed to develop an innovation platform as one element of cluster glue. Glue can arise from inside the cluster based on mutual recognition of common interests or be provided externally through policy interventions. Often both forms are needed, but externally injected glue can at best be a catalyst to help boost the effectiveness of internal glue. Unless there is some commitment of members of the cluster to a common cause and trust between them external interventions will not work.

The SWOT analysis of the four regions shows that there are common actions that can be taken to facilitate the development of local cluster and cover the most critical aspects of the value chain. The study can also be considered as a reference point from which the regions can refer to in order to implement and share strategies to exploit the potential benefits of Horizon 2020.

The EU stakeholders, whether based on the studied region or elsewhere, can benefit from this study in that it is the first of its kind to focus on SMEs with suggestions on how the new world of electromobility can be addressed and which identifies opportunities for generating a variety of new green jobs. The study found that the SMEs will play a relevant role in the new value chain of electromobility, the need to inform policy makers and society as a whole that electromobility offers the opportunity to generate plenty of new green jobs with much lower levels of investments than would be needed to support the "survival" of the ever more unsustainable conventional hydrocarbon based industries, that every EU country can develop the manufacturing of new "game changing" electromobility technologies that do not require the usual technical and financial support of large OEMs.

Developing, coordinating and supporting SME engagement is seen as a key factor in transforming the transport sector. An improved and more competitive sector is required not only to ensure that the EU meets its own energy reduction targets but also to ensure that it can become more innovatively competitive on a global scale, through the creation of a European competitive green economy.

Recommendations

It is clear the role SMEs have on innovation in the transport sector: SMEs employ about 55% of EU auto-workforce, some act as TIER1s, most as TIER2s; many are providers of specialists to either TIER1s or directly to manufacturers OEMs.

According to the INTRASME studies, SMEs participate in all phases of the innovation value chain, including: R&D, the first concept, vehicle design and modelling, engineering, manufacturing, services and sales.

So far the Internal Combustion Engine (ICE) has been the heart of the automotive industry in Europe: the complexity of this industry is such that innovation could be driven and made only by few organizations.

The advent of electro mobility has changed the context: innovation can be made by many organizations, with SMEs playing a key role as long as they act and address the light EVs and Micro e-cars sectors, where adaptation capacities, flexibility and efficiency are required and the conventional auto-motorcycle industry cannot fully compete. Three wheelers, low speed vehicles and Micro e-cars are clearly new exploding businesses open to SMEs which can conceive, design, develop, prototype and produce safe, ergonomic and energy efficient vehicles meeting most people needs.

To generate a sustainable business SMEs should consider that whatever electric vehicle will be produced:

- Safety
- High quality standards (reliability)
- Ergonomics
- Aesthetics
- Smartness
- Low production cost

are not optional. European customers are the most demanding and those SMEs aiming at becoming OEMs with large scale manufacturing of e-vehicles must seriously consider those basic points otherwise sooner or later they will face severe problems.

In these emerging markets very different business models are possible; strong collaboration between SMEs and TIER1s results in advantages in order to produce safe-efficient vehicles that can be distributed even without the support of large OEMs.

In such a rapidly changing, evolving and growing market, SMEs willing to address this identified niche area need to be oriented towards new business models, emerging sectors and technologies, new funding models and tools, relevant value chains and innovation stakeholders, customer needs understanding, etc.

There is a need for new instruments that could allow EU companies (SMEs and TIER1s) to emerge and lead the manufacturing of this new fast growing sector of electro mobility. Looking at the smart mobility sector, energy efficiency, low-carbon mobility solutions, electric vehicles, satellite-enabled solutions, all these areas are stimulating the emergence of thousands of applications developers, and especially Micro, Small and Medium Enterprises.

The INTRASME project was created to respond to these challenges. Partners considered different aspects affecting the market uptake of European SMEs in these emerging areas: which opportunities are now available for SMEs in the transport sector, which role is reserved to SMEs in European R&D projects, how SMEs can better exploit and disseminate R&D results, which barriers SMEs face entering these programmes and how they can overcome them.

Moving from this initial analysis, INTRASME partners organized a set of activities and developed a set of tools to meet these needs and enhance a European innovation platform dedicated to SMEs and value chain stakeholders in the electro and smart mobility sectors. INTRASME has promoted the introduction of new instruments to facilitate:

- The generation of regional clusters with complementary SMEs and Tier1s (Torino e-district and the UK Proving Factory are two examples)
- The formation of superclusters amongst specialized regions motivated to generate a community (open platform) in which visions and knowledge are shared toward product developments personalised to the specific regional needs.

Drawing on the experience gathered throughout the implementation of the project, having considered regional and European mechanisms to support innovative SMEs in the new transport areas to uptake new markets in a more efficient and faster way, the INTRASME project has provided a set of **policy recommendations**:

- on mechanisms/initiatives including collaborative projects to strengthen innovation links in EU regions with weak innovation links
- to make EU R&I area more attractive to SMEs.

These were debated and validated during a Policy Workshop partners organized in Berlin on April 3rd, 2014. Having collected different perspectives, followed by analysis and synthesis of the outcomes, the conclusions were presented at the Transport Research Arena 2014 (TRA) event.

During the workshop 3 key areas were discussed:

1. **Identified Barriers & Mechanisms to overcome them** - SMEs' role in the transport industry, their major role in contributing to the economic and environmental objectives of the European Union: how to support the development of small and medium sized firms able to take advantage of emerging electric vehicle and smart mobility technologies
2. **How to bring innovative products/services to market more efficiently** - Exploitation of SMEs' innovations resulting from EU R&D project results
3. **The role of SMEs on Innovation in the Transport Sector** - Rethinking regional and European policies for low carbon transportation and smart mobility sectors: key role of regional clusters and international sectorial super-clusters

The experience of the INTRASME project, examining the factors improving the capacity and capability of European SMEs to more rapidly develop and implement products and services in the low carbon transportation and smart mobility sectors, has clearly presented the barriers and the gaps European SMEs have to face when bringing innovative technologies to the market.

Barriers cited by SMEs to exploiting their innovations in order of importance (INTRASME interviews)	**Proportion of SMEs (%)**
LINKING TO EXPLOITATION PARTNERS - OEMs, TIER 1s/ TIER 2s ETC	57%
FINANCE AND BUSINESS CASE (INCLUDING MARKET NEED)	48%
INNOVATION AND LINKS TO UNIVERSITIES/ RESEARCH INSTITUTES	38%
PRODUCTIONISATION	29%
NEED TO JOIN CLUSTERS FOR CRITICAL MASS	29%
NEED TO UNDERSTAND EC PROGRAMMES AND BID PROCESSES AND FOR GUIDANCE AND SUPPORT	19%

Actions are urgently needed at policy level to improve the potential exploitation of research results, and to support the innovation potential of SMEs in the electro mobility and Smart Mobility sectors.

The recommendations can be summarized as follows:

I. Innovative ways of encouraging SME participation in EU research activities should be investigated.
II. Improvement of EU funded R&D framework and processes to ensure focus on exploitation results and facilitate participation of SMEs in these programmes.
III. Faster and more effective funding mechanisms are needed to support the 'fast and furious' market uptake of European SMEs in the EV and Smart Mobility sectors, for example more risk financing is needed for SMEs on technology development.
IV. Dialogue with regional authorities should be encourage to simplify standards, accreditation and test procedures. SMEs should be actively engaged in this dialogue.
V. Strengthening links between SMEs and academia is a priority in order to boost SMEs innovation capabilities: entrepreneurial attitudes should be embedded in the academic world.
VI. Transnational thematic clusters should be further encouraged to create a "shared" vision, together with academia, public sector and industry, on the role of SMEs in the EV and SM innovation chain.

Impact

The 2012 Transport Work Programme identified three major socioeconomic challenges, all of which were addressed by the INTRASME Support Action:

1. Eco-innovation – The decarbonisation of the transport system and an efficient use of natural resources, i.e. eco-innovation in all transport modes and the further development of clean vehicles and vessels.

INTRASME focused on Low Carbon road and air vehicles. In particular the focus on LEVs and novel forms of e-mobility (bikes, cars, and aircraft) will also bring personal mobility to developing regions, addressing the social inclusion point in (2) below**.**

2. Safe and seamless mobility – The optimisation of global efficiency and safety of the transport system (by application of Intelligent Transport Systems and logistics), making efficient use of infrastructure and network capacity, with the aim of offering safe and seamless transport and mobility to all European citizens, as transport is crucial for social inclusion.

INTRASME focused on Smart Mobility for seamless end-to-end journey management, helping the movement of people and goods to be more efficient through integrated ticketing and shared information systems.

3. Competitiveness through innovation – The strengthening of the competitiveness of European transport industry through innovation, as competition from developed and emerging economies is intensifying in a global economy.

INTRASME focused on supporting innovative SMEs to pull through new developments into production of novel vehicles in a 'fast and furious' paradigm to maximise this resource and strengthen the EU in competition with emerging economies.

INTRASME focused its activities as below:

- A sub-set of EU R&D projects was targeted with significant involvement of SMEs in the LCV, light aircraft and smart mobility sectors. Exploitation plans were developed for these projects, as well as guidelines for exploitation plans for other projects.
- Support mechanisms were developed and opportunities identified for SMEs to rapidly bring their innovations to market in the above sectors. This exploited, in particular, the synergies in the enabling technologies in LEVs and light aircraft.
- Three Innovation Networks were established, one in each of the above sectors. These were piloted based on emerging clusters in UK/Midlands, Italy/Piedmont and Poland/Warsaw, which have identified weaknesses and the concept was extended to Ruse (Bulgaria) where innovation links are weaker.

Societal and economic impact

As a supporting action INTRASME supported the collation and dissemination of best practice in innovative product and service development in the transport sector of SME's across Europe. This was achieved through the provision of a European focused information platform and through the provision of roadshows, workshops and conference sessions directed at supporting SME's in the development of innovative transport products and services.

On this basis 3 key areas that determined that the impacts detailed above are achieved:

- Extensive usage of the internet platform
- Engagement/uptake of SME's: hundreds of SMEs were assisted through the roadshows and workshops
- Quality of the information used and frameworks produced: 3 Pan-European innovation networks were established. Excellent feedback was received by the participants (SMEs) of the sessions

Although the main results of INTRASME targeted policy makers, they had an impact on society and economy too. SMEs are the backbone of the European economy. Developing, coordinating and supporting SME engagement is seen as key in transforming the transport sector and boosting the economy. An improved and more competitive sector was required not only to ensure that the EU meets its own energy reduction targets but also to ensure that it can become more innovatively competitive on a global scale, through the creation of a European competitive green economy.

Existing policy, programmes and initiatives indicate that innovation networks fail and complex transport supply chains act as barriers to the implementation of new and emerging innovations in the sector. It is these failures that are leading to the underachievement of SME engagement in the transport sector, and in particular in low carbon transportation, leading to slower than required growth, and slower than expected CO_2 reduction results. SMEs represent 99% of businesses in Europe, and are a key driver for economic growth, innovation, employment and social integration.

INTRASME supported SMEs on following levels:

- Provision of Guidelines for Exploitation (use) and dissemination plans from SME to project level
- Exploitation and dissemination plans for selected EU R&D projects
- Provided informative reports on opportunities from new forms of transport
- Help develop links between regions, i.e. develop 'Innovation Networks' in the 3 topics (LEVs, light aircraft, smart mobility).
- Provided a number of support mechanisms (roadshows, workshops, online platform)
- Help to improve supply chain linkages within a region between universities, SMEs, suppliers, manufacturers, end-users - aimed at regions where innovation links are weak.

The above actions significantly improved innovation capacity and addressed the difficulties faced by SMEs and enhanced the capacity of EU-funded Framework Programme projects in the field of transport to be at the forefront of innovation and helped businesses transform research results into products and services.

Policy Impact

So far there was no centralised innovation network enabling organisations – including SMEs- to engage in knowledge sharing and best practice sharing around innovation exploitation in the transport sector and allowing new transport concepts to be quickly conceived and produced. INTRASME reviewed existing European programmes to consolidate best practice and ensure widespread dissemination and knowledge sharing across the sector.

INTRASME has studied the role and activities of SMEs in EU projects. Moreover, the project has identified how SMEs acquire new technologies in different regions. The aim of these reports was to provide policymakers with information on the status quo of SMEs in terms of innovation. This will enable the relevant authorities to direct funds to the appropriate schemes and avoid wastage of resources.

The INTRASME project has examined the role and activities of SMEs in EU R&D Projects in Low Carbon Transport and Smart Mobility, the barriers they encounter and the strategies used to exploit their technology, presented a set of recommendations to make EU R&D more accessible and more effective at exploiting the innovations of SMEs. The recommendations report included suggestions to both regional policymakers and the European Commission.

Finally, a thorough set of recommendations have been developed at the end of the project. A number of experts contributed and validated the intention of the recommendations. This report is mainly aimed at providing the European Commission with some guidance in terms of how to design initiatives that strengthen innovation links in EU regions how to make the EU RTD area more attractive to SMEs.

Beyond the direct recommendations provided by the project, we also implemented a number of support activities into three pilot regions (West Midlands/UK, Piedmont/Italy, Warsaw/Poland). The partners in INTRASME represented 3 important regions of the EU. These are regions with strong SME activity, which is untapped for exploitation of new

technologies and solutions in the rapidly growing low carbon mobility sector due to a range of challenges. One of the key challenges was the dominance of large OEMs in road transport and aerospace and inflexible supply chains which inhibit the incorporation of new solutions.

As described above, through the pilot actions, three Innovation Networks were established. The impact of that was enhanced by the development of an easy-to-use, interactive and engaging Innovation Network Support and Best Practice Toolbox web based platform. The platform ensured an integrated innovation environment through the dissemination of tools, good practices, products, projects and services in the field of road transport, air transport and smart mobility. Policymakers were key stakeholders of the Innovation Networks and their contact with the rest of the stakeholders will be maintained after the end of the project. This will enable them to extract the necessary information and updates from the SMEs and from the market in general so as to be able to better design and implement support tools.

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