MAPPING OF REGIONAL TRANSPORT RTD FRAMEWORKS IN EUROPE

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Abstract: Transport is a key enabler of economic and social activity, but also the source of environmental concerns and other negative externalities. The efficiency of a transport system affects the costs and environmental impacts of the growing volumes of passengers and freight. According to the White Paper (2011), innovation is essential for the development of a European transport strategy in order to achieve the identified challenges. Therefore, this paper presents the results of a mapping process of regional research and innovation activities across the European transport sector. It is based on the intermediate results of FP7 project METRIC ("Mapping European Regional Transport Research and Innovation Capacities"). Particular attention has been given to the examination of prioritized objectives in R&I infrastructure in different EU countries, with specific emphasis on the area of regional transport research.

The mapping process was based on efforts to collect significant amount of useful indicators and indexes relating to European regions (quantitative data), as well as relevant policies, initiatives, strategies, clusters, actors, etc (qualitative data). The sets of quantitative data are mainly taken from EUROSTAT and Cluster Observatory websites. Qualitative data was determined from numerous other sources, such as relevant web sites, reports, papers, etc. Lessons have been drawn from specific regional cases of transport research and innovation policy governance. In this respect, we elaborated and researched the state of regional research and innovation activities, policies and programmes and their most recent trends in European regions at NUTS2 level.

Furthermore, we also detail the importance of various transport sectors for a selection of NUTS2 regions. The work undertaken also included an analysis on how the priorities of innovation and RTD strategies are formulated, determined what type of innovation is the focus of transport sector, and how this varies across European regions.

Keywords: transport sector; research and innovation activities; mapping process; European NUTS2 regions; innovation priorities

1. Introduction

Transport is the backbone of the European economy, accounting for about 7 % of GDP and more than 5 % of total employment in the EU (METRIC DoW Annex 1). EC MEMO, 2012 indicate that "increased cooperation and prioritization in transport research and innovation" could provide benefits for Europeans as well as for the European industry. These processes require the development and implementation of 'innovation roadmaps' that would help accelerate the generation of new knowledge as well as the exploitation of existing cutting edge research results. Therefore, new and innovative technologies are essential for reducing Europe's dependence on oil and production of GHGs, maintaining our mobility in a sustainable manner, improving the competitiveness of European transport industry, increasing productivity, preserving the jobs, raising standards of living and supporting economic growth in Europe.

Regions are considered as the key actors of growth models driven by innovations. Their role in innovation systems is rather complex. OECD (2011) shows that: i) regional innovation systems follow varied development paths; ii) heterogeneity can sometimes be more pronounced within countries than between countries; iii) while R&D and patenting are mostly concentrated in key regions in top OECD innovative countries, new regions are emerging as knowledge hubs; iv) regional collaboration and networks are becoming increasingly relevant for innovation; v) firms carry out both technological innovations (new products and processes) and non-technological innovations (such as new business models and organizational methods); and vi) design and creative industries are strongly shaped by regional factors and are vital for regional competitiveness. Therefore, to understand the differences in the status of transport researches in European regions, it is essential to take into account and analyze different type of regions or a selection of regions with different levels and importance given to transport researches. This is also the same with any other type of researches.

This paper presents the results of the METRIC project efforts to map the data on existing RTD activities in European regions. Particular emphases have been put on the transport sector. Efforts in this mapping process have been directed to the collection of as much as possible relevant quantitative and qualitative data. Success in the process of data collection influenced the structure and the content of the intermediate METRIC result. These results refer to the process of building the METRIC database, as well as putting together the relevant deliverables and papers.

Our mapping process was based on efforts to collect significant amount of useful indicators and indexes relating to European regions (quantitative data), as well as relevant policies, initiatives, strategies, clusters, actors, etc (qualitative data). These sets of quantitative data are mainly downloaded from Eurostat and Cluster Observatory websites. Due to the complexity of the data and these databases, all these sets were processed in a way that the data can be easily interpreted at the regional level and, as such, included in the METRIC database - entitled "FP7 METRIC Regional Transport RTD & Innovation Repository". While building the repository, we have also developed a tool for graphical presentation and elaboration of the data contained in the repository. A user of the tool is not only able to determine relevant data, but also perform basic mathematical operations with the data, export it to Microsoft Excel for possible additional handling of data or download the graphs with the required data. Furthermore, qualitative data were taken from numerous resources, including relevant web sites, reports, papers, etc. Database of such qualitative data on research and innovation in European regions has already been developed by European Commission and is available at the Regional Innovation Monitor Plus web site (http://ec.europa.eu/).

The rest of this paper is organized as follows. Chapter 2 of this paper deals with regional dimension of innovation systems, as well as concepts of national and regional innovation systems. Chapter 3 reveals the significance of transport or transport sectors and relevant research activities for some of the selected regions. This chapter also deals with responsibilities for science, research and innovation policy in European countries. Chapter 4 mutually compares priorities of analyzed regional research and innovation strategies and regional operational programmes with particular focus given to transport sector. Chapter 5 concludes the paper.

2. Innovations and regional systems

As recent empirical studies indicate that geographical proximity is a prerequisite for learning and innovation (Autant-Bernard and Massard, 2009), it is obvious that spatial dimension should be of primary interest for regional policy makers. However, Autant-Bernard et al., 2013 also state that even where they exist, the effects of proximity are never exclusive, and interact with effects far more remote nationally and internationally. Thus, the geographical proximity effects have to be combined with other dimensions, such as organizational, institutional or cognitive proximity. The same authors conclude that geographical proximity, per se, is neither a necessary nor a sufficient condition for learning to occur. However, it generally facilitates interactive learning by strengthening the other dimensions of proximity (Boschma, 2005).

In addition, Peri (2005) estimates that the likelihood of patent citations decreases by 75% when crossing the regional border (slightly higher than Jaffe et al.'s (1993) estimations, which indicated a decline between 50 and 60%). Only 20% of average knowledge is learned outside the average region of origin, and only 9% is learnt outside the country of origin. Bottazzi and Peri (2003) explain patent production in European regions by the research performed at different geographical levels: within the region, within regions situated at less than 300 km distance and within regions situated at a distance between 300 and 600 km. According to their results, doubling R&D spending in a region would increase the output of new ideas in other regions within 300 km only by 2–3%, while it would increase the innovation of the region itself by 80–90%. Using French data, Autant-Bernard (2001) produce a weaker parameter of spatial decay. For public research, inter-regional spillovers are four times as small as intra-regional spillovers. For private research, the human capital effects are divided by two when moving from the region to its neighbours. According to Eurostat figures, only 27 of the 260 regions spend the equivalent of over 3% of their GDP on research and development whilst over 40% of the EU's total R&D expenditure of around EUR 200 billion is generated in these regions.

In general, regions represent political governance systems, below the national but above the local level of public administration. The concepts of innovation system at national level, as well as at regional levels are given in Fig. 1 and Fig. 2. Cooke, 1998 state that regional innovation systems are not being present in many countries. Even if they exist, they may be diverse in nature and dominated by a major industry. Such an industry is usually characterized with its strong regional supplier linkages and connections to public or private research laboratories and higher education. Alternatively, Cooke, 1998 also indicate that, as with many industrial district regions, there may be few direct links to research laboratories but many to various intermediaries and service providers, including regional and local public providers.

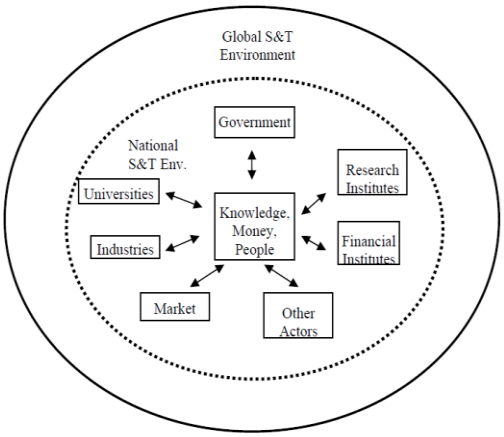

Fig. 1.
National Innovation System
Source:http://www.unescap.org/tid/publication/indpub2507_chap3.pdf

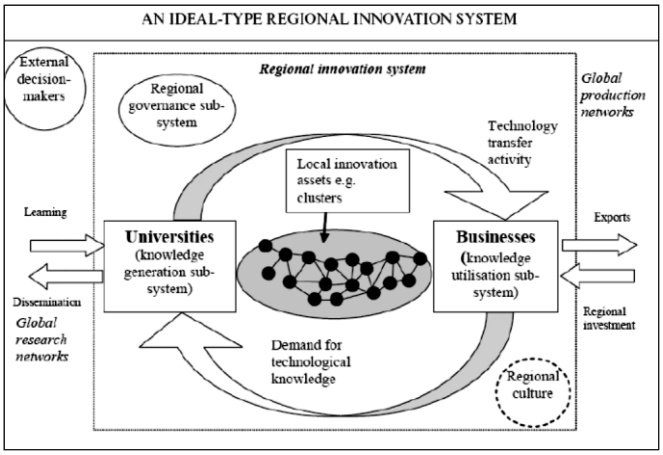

Fig. 2.
An ideal-type Regional Innovation System (RIS)
Source: (Engelhardt, 2013)

3. Mapping process and the database

This chapter is based on desk based analysis of relevant literature and on on-going work being undertaken by the European Regional Innovation Monitor (RIM), ERAWATCH, Eurostat, and other relevant databases and reports. RIM is an initiative of the European Commission's Directorate General for Enterprise and Industry, which has the objective to describe and analyze innovation policy trends across EU regions. RIM covers EU-20 Member States: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Poland, Portugal, Romania, Slovakia, Spain, Sweden and the United Kingdom. ERAWATCH offer a unique policy monitoring and benchmarking service on the full range of research and innovation policies in the EU and beyond. Eurostat's Community Innovation Survey (CIS) is the main data source for measuring innovation in Europe.

The chapter analyses and synthesizes trends in the regionalization of European research and innovation policy and the implications this has for the interactions between national and regional policy governance based on a review of academic and policy literature. Lessons are drawn from specific regional cases of transport research and innovation policy governance and policy. We also introduce and explain the responsibility for science, research and innovation policy in European countries. In this respect, we performed an elaboration of the state of regional research and innovation policies and programmes with a focus given to transport sector.

3.1. Selected NUTS2 regions

European regions (majority is NUTS2 regions) which have been taken into account are introduced here. Several of these regions are related to the whole country, i.e. specific country constitutes the NUTS2 regions. These countries are identified as follows: Cyprus, Estonia, Latvia, Lithuania, Luxemburg, Malta, Slovenia[1] and Iceland. In addition, Serbia is consisted of five NUTS2 regions, but due to the lack of available data, the country is analyzed at a national level.

Transport as a whole or its related sectors are regarded as very important for the development of some of the considered NUTS2 regions. Detailed analysis, performed in METRIC project, as well as other relevant materials (EC, 2013; TRIP, 2013), revealed the significance of transport or transport sectors and relevant research activities in some of the selected regions. The selected and analyzed NUTS2 regions are the following[2]: Austria (Lower Austria; Upper Austria-automotive sector), Belgium (Southwest Planning Region), Croatia (Northwestern Croatia), Cyprus, The Czech Republic (Praha), Denmark (Hovedstaden; Zealand- transport and eco-mobility), Estonia, Finland (Etelä-Suomi; Länsi-Suomi), France (Île-de-France-other transport technologies, i.e. other than aeronautics and space and automobile; Rhône-Alpes-other transport technologies and automobiles), Germany (Bayern-NUTS1-automotive industry (Audi, BMW, MAN, Knorr-Bremse); Lower Saxony-NUTS1-automotive sector (80 % of all R&D capacities are concentrated in the automotive sector), aeronautics, the shipbuilding and the railway-technology), Greece (Attiki), Hungary (Central Hungary), Italy (Lombardy-sustainable mobility (modal integration – road, rail and metro, car pooling, car sharing, road pricing, etc); Lazio-accessibility to environmentally-friendly transport services); Latvia-relatively specialized in transport technologies other than automobiles and aeronautics; Lithuania-other transport technologies (other than automobiles and aeronautics), transport, logistics and e-systems; Luxemburg-space-satellite telecommunications and automobiles, Malta-development of the transport infrastructure; The Netherlands (Noord-Brabant-maintenance

[1] Slovenia is considered as a single region at the NUTS 2 level. Still, for the purposes of the EU cohesion policy, two cohesion regions were introduced in Slovenia Vzhodna Slovenija (Eastern Slovenia) and Zahodna Slovenija (Western Slovenia).
[2] Analyzed regions and relevance of transport or transport sector in these regions are given in parenthesis.

(aircraft, cars, ships); Groningen-transportation, storage and communication), Poland (Mazowieckie; Slaskie; Opolskie); Portugal (Lisbon- automotive, aeronautics, logistics and transportation); Romania (Bucharest-Ilfov), Slovakia (Bratislava), Slovenia (motor vehicles), Spain (Catalonia), Sweden (Stockholm), United Kingdom (London-NUTS1- major national and international transportation hub; West Midlands-NUTS1-automotive, rail and aerospace; Wales-NUTS1), Iceland- transport in sparsely populated areas; traffic in cold climates; air traffic management), Norway (Oslo og Akershus- other transport technologies), Serbia, Switzerland (Espace Mittelland; Zurich).

3.2. Research and innovation policy – responsibility

Responsibility for science, research and innovation policy in European countries might be allocated to different levels of policy-making. In some European countries, development of research and innovation policies and programmes is a task of national authorities. In other countries, regions are in charge of setting up frameworks for research and innovation. There are also countries where these responsibilities overlap between national, regional or community levels. This is clearly presented in Table 1. This table also lists relevant documents which constitute a framework for research and innovation activities at national or regional level. Relevant sets of data are obtained from METRIC research efforts and taken from relevant web sites of European Commission, Regional Innovation Monitor and Regional Policy – INFOREGIO.

Table 1.
Responsibility level for R&I policies and strategies in European countries

Country	Responsibility level	Relevant documents
Austria	national level	✓ 2012 National Reform Programme; ✓ National Reform Programme, 2008-2013; ✓ Becoming an innovation leader', published in 2011; ✓ National Energy Strategy from 2010.
Belgium	communities and regions	✓ The Flemish Science and Innovation policy – Flemish region; ✓ "Marshall Plan 2. Green" – Walloon region; ✓ Regional Plan for Innovation - Brussels-Capital
Bulgaria	national level	✓ National Strategy of Scientific Research 2020
Croatia	national level	–
Cyprus	national level	✓ Strategic Development Plan for 2007–2013; ✓ Revised National Reform Programme of the Republic of Cyprus
Czech Republic	national level	✓ National Research, Development and Innovation Policy 2009–2015 – RDI
Denmark	national level	✓ Strategic Research Principles and Instruments, 2012; ✓ RESEARCH 2015 and RESEARCH 2020
Estonia	national level	✓ Estonian Research, Development and Innovation Strategy 2007–2013 (RDI); ✓ Knowledge-based Estonia
Finland	national level	✓ Research and Innovation Policy Guidelines 2011–2015
France	national programme	✓ The National Research and Innovation Strategy for period; 2009–2012
	national research programmes with a regional focus	✓ The competitiveness clusters; ✓ The higher education and research poles (PRES); ✓ The thematic networks for research (RTRA)
Germany	federal level	✓ High-Tech Strategy 2020 – one of priorities is communication and mobility;
	16 German states – Bundesländer	✓ **Entrepreneurial Regions" (*Unternehmen Region*);** ✓ "Regional Research and Innovation Strategies on Smart Specialisation-RIS3"; ✓ "Inno-Regio Programme" and its follow-up programmes, "Innovative regional growth centres" and "Interregional alliances"
Greece	national level	✓ Strategic Development Plan for Research, Technology and Innovation; 2007-2013
	research policies at regional level	✓ developed by most of Greek regions
Hungary	national level	✓ Strategy Programme of the Hungarian Transport Research – Transport Mobility, Transport Economics, Infrastructure, Energy and Environment, Traffic Safety and Security, Intelligent Transport Systems; ✓ National Development Concept – 2012-2020, priorities include automotive

		and logistics sectors; ✓ Government's Mid-Term Science, Technology and Innovation Policy Strategy – 2007-2013; ✓ New Hungary Development Plan including the Transport Operational Programme – 2007-2013; ✓ New Szechenyi Plan – 2010-2020
	Regional innovation policies per se do not exist	
Ireland	national level	✓ National Development Plan – 2007-2013: priorities in the transport sector are to improve the inter-urban road network and public transport services, as part of an integrated approach to meeting transport needs; ✓ Strategy for Science, Technology and Innovation – 2006-2013; ✓ Innovation Ireland – 2014-2020; ✓ Statement of Strategy – 2011-2013: main principles, priorities and goals for transport policy; ✓ Smarter Travel Plan 2009–2020: ✓ the Framework Policy for Sustainable Transport; ✓ National Cycle Policy Framework *Transport 21*
Italy	important documents at national level	✓ National Reform Programme for innovation, Growth and Employment; ✓ Triennial National Research Programme 2011–2013: ✓ one of the identified thematic priorities for the national research policy is Sustainable mobility
	regions have full autonomy in RDTI policy	
Latvia	national level	✓ Guidelines for Development of Science and Technology for 2009-2013
	planning regions have neither the level of responsibility nor the funding capacity to develop their own research policy	
Lithuania	national level	✓ National Innovation Strategy – 2010-2020; ✓ National Higher Education and Research Policy (transport is not included in the list of priority research areas)
	there are no functional regional research policies or programmes	
Luxemburg	national level	✓ CORE programme 2008-2013; transport research does not have a priority status
Malta	national level	✓ National Strategic Plan for Research and Innovation – 2011–2020
	no regional research programmes	
The Netherlands	national level is responsible for the research policy	✓ National innovation strategy - "Naar de top": logistics is one of nine identified "top sectors"; ✓ Strategic Agenda for Higher Education, Research and Science – published on 1 July 2011; ✓ National Planning Strategy up to 2020 and for the period 2020–2030
	provinces develop regional innovation policies	✓ RAAK (Regional Attention and Action for Knowledge circulation) programme – specific policy programme that focuses on regional development
Poland	national level has a significant role to play in research, development and innovation	✓ National Programme for Scientific and Research & Development (R&D) Activities ✓ National Development Strategy for 2007–2015 ✓ National Strategic Reference Frameworks for 2007–2013 ✓ State Transport Policy for 2006–2025
	regional level	✓ regions are increasingly playing their role in regional innovation policies in terms of responsibilities and financial means ✓ major tasks of regional self-authority are regional roads and transport management and water transportation
Portugal	national level	✓ Portuguese Strategic Programme for Entrepreneurship and Innovation, end of 2011 ✓ Pluriannual Funding Programme ✓ National Strategic Reference Framework 2007-2013

	regional level	✓ no scope for regionally defined policies aiming at research and innovation promotion, with Azores and Madeira regions as possible exceptions
Romania	central government is responsible for the RTDI programmes	✓ Research Development and Innovation National Strategy – 2007-2013 ✓ National Research Development and Innovation Plan II – 2007-2013 (NP II) ✓ Reform Action Plan for R&I – adopted in 2011 ✓ National Strategy for Sustainable Development - Horizons 2013–2020–2030, part: Action Plan for implementing the Sustainable Transport Strategy in the period 2007–2013, and 2020–2030 ✓ National Strategic Reference Framework 2007-2013 – part: Sectoral Operational Programme-Transport
	no regional research programmes	
Slovakia	national level	✓ State S&T Policy up to 2015 ✓ 2010 New Model of Financing Science, Technology ✓ "Minerva 2.0" strategy ✓ Innovation Strategy – 2007-2013 ✓ Innovation Policy – 2011-2013 ✓ Transport policy up to 2015 ✓ Strategy of the Development of Transport up 2020
	regional R&D and innovation programmes	✓ no explicit regional R&D and innovation programmes and policy initiatives, but regional governments approve regional innovation strategies ✓ other transport technologies and manufacture of electrical motors are among main technology sectors (particular in automotive sector)
Slovenia	national level	✓ Research and Innovation Strategy of Slovenia 2011-2020 (RISS); National Higher Education Programme 2011-2020 (NHEP); National Research Framework Programme Slovenian Competitiveness 2006–2012
	necessity of regional policy for R&D is not explicitly mentioned in the official strategic documents	
Spain	national level	✓ National Science and Technology Strategy–ENCYT ✓ National Scientific Research, Development and Technological Innovation Plan – National R&D&I Plan, Strategic Plan for Infrastructure and Transport – PEIT, 2005–2020 ✓ The National Strategy for the Electric Vehicle, 2010-2014 ✓ Energy Saving and Efficiency Strategy Action Plan, 2008–2012
	Spanish regions are designing their new innovation strategies aligned with smart specialization	
Sweden	research policy is decided at national level	✓ national strategy for transport related RDD – Research, Development, Demonstration ✓ Multimodal Strategy and Action Plan for the Use of Intelligent Transport Systems up to 2015 ✓ National Plan for Sweden's Transport System for 2010–2021 ✓ Strategy on Sustainable Development of the Baltic Sea, 2010–2015 ✓ Vehicle industry research programmes – since 1994 ✓ Social and Economic Significance of the Automobile, BISEK programme ✓ Second generation biobased motor fuels ✓ Energy efficient reduction of exhaust emissions from vehicles ✓ Governing transitions towards Low-Carbon Energy and Transport Systems for 2050 (LETS 2050) ✓ Forska&Väx
	programmes that are aimed for regional development	✓ VINNVÄXT programme ✓ Regional growth programmes ✓ transport technologies, motor vehicles are the areas with intensive patenting
United Kingdom	national level	✓ Science and Innovation Investment Framework – 2004–2014 ✓ The Innovation and Research Strategy for Growth, published-end of 2011 ✓ The Future of Transport White Paper ✓ Technology Strategy Board Innovation Platforms: Low Carbon Vehicles and

		Intelligent Transport Systems & Services
	regional level	✓ some of the regions in UK are granted a special status and more competencies towards self-governance ✓ automobiles is one of key science and technology areas based on the numbers of scientific publications and patents ✓ UK has a world-class reputation in aerospace research
Iceland	national level	✓ Iceland 2020 ✓ The Icelandic national transport policy, 2003-2014 ✓ Building on Solid Foundations ✓ Science and Technology Policy for Iceland 2010-2012 ✓ National Transport Plan 2009–2012
	there are no regional research programmes	
Norway	national level	✓ Innovation White Paper "Climate for Research" ✓ National Transport plan 2010-2019 ✓ Intelligent Freight Transport – SMARTRANS, 2007-2013 ✓ TRANSNOVA, 2009-2011 ✓ Norwegian Centres of Expertise (NCE) programme, launched in 2006 ✓ Arena programme, organized in 2002 and evaluated in 2011 ✓ Freight Transport and Logistics, 2007-2010 ✓ Sustainable Urban Transport, 2007-2010 ✓ Risk and safety in transport – RISIT, 2002-2009 ✓ Climate and Transportation
	regional level	✓ The Research Council's programme for R&D and innovation aims to transfer more responsibility for R&D and innovation activities to the regions (VRI programme-Programme for Regional R&D and Innovation, introduced 2007)
Serbia	National research programmes – nation-wide programmes	✓ National strategy for science and technological development, 2010-2015 ✓ Strategy of development of rail, road, water, air and intermodal transport in the Republic of Serbia, 2008-2015
	almost no regional RTDI programmes	✓ research governance is to a limited extent transferred to the Autonomous Province (AP) of Vojvodina ("Basic Directions of Technology Development of AP Vojvodina")
Switzerland	national research programmes launched at the federal level	✓ National Transport Policy "Making Mobility Sustainable and Fully Integrated" ✓ "Sustainable Development Strategy" – 2012–2015 ✓ The Swiss Energy Transports research programme ✓ The Accumulators / Supercapacitors research programme
	no regional research programmes, neither programmes that are initiated by the federal government (e.g. national research programmes with a regional focus) nor programmes that are started by the cantonal authorities (regional research programmes)	

In addition, relevant transport research and innovation programmes may be found in two analyzed regions in Germany[3]. These are:

- Bavaria – 12 technology-specific innovation policy programmes; 9 technology-open programmes (end of 2012), among them, four programmes are in the area of mobility and renewable energies: Program "e-mobility"; Demonstration projects for energy use of biomass; Promoting innovative energy technologies and energy efficiency (BayINVENT); Research and development projects in the field of biotechnology and genetic engineering (BayBio);
- Niedersachsen (Lower Saxony) – 13 programmes aiming at the promotion of research, development and innovation primarily for companies, universities and research institutions; 12 of these programmes do not aim at strengthening specific technologies, but the innovation performance of companies in general; one programme, "Aviation funding guidelines", was only aimed at promoting R&D in a field of aviation research.

[3] In Germany, the smallest administrative level is not the "Bundesland" (e.g. Bayern) but the "Regierungsbezirk" (e.g. Oberbayern). Those can / must create partly own research and innovation programs.

4. Innovation and RTD priorities

With our efforts, we have also aimed to answer, to some extent, the following questions:

- What objectives are prioritized in R&I infrastructure in different EU countries?
- What type of innovation is the focus of transport sector, and how does this vary across European regions?
- To what extent is transport research and innovation across European regions coordinated with other relevant programmes and strategies (i.e. where are synergies, overlaps and gaps)?

To answer these questions, we mutually compared the priorities of regional innovation strategies (RIS) of analyzed regions and relevant regional operational programmes (ROPs). Activities defined in the innovation strategies may be or, in some cases, are implemented through the projects within the regional operational programmes. Therefore, innovation strategy should be compatible with the regional Operational Programme (e.g. Regional Innovation Strategy for Malopolska Region). Furthermore, priorities given to projects funded within ROP are often based on the specialization fields identified in regional innovation strategies (e.g. ROP for the Śląskie voivodship, ROP for the West Pannon). Obviously, compatibility of regional innovation strategies and regional operational programmes is an important segment of successful strategic planning of R&I activities at regional level. Therefore, in this chapter, particular attention is given to the transport related priorities and relevant compatibility of elaborated strategies and programmes.

Of the 44 analyzed regions, a total of 7 (15.9%) regions (i.e. 6 NUTS1 or NUTS2 regions – Upper Austria, Bavaria, Lower Saxony, Közép-Magyarország, Stockholm, West Midlands, and one country – Estonia) were identified that explicitly define transport research as a research priority in their respective R&I strategy. These transport research related priorities differs among each other and go from the general approaches such as transport, transport logistics, transport technology and mobility, to more specific transport mode or technology like automotive industry, innovative future technology such as aerospace technology or fuel cell technology. These priorities also cover transport infrastructure aspects (development of region's transport infrastructure; effective infrastructure such as roads, railways, airport and ports).

On the other side, transport related priorities are included in the Operational programmes (OPs) of analyzed regions at much higher levels. Out of these 44 analyzed regions, regional OPs are identified for 35 of them. In total, 28 regions (80 %) included transport related issues among the priorities of their OPs. These priorities comprised the following aspects and its related areas:

- **Accessibility** (public transport and transport accessibility; quality of the public transport; regional public transport; improvement of the accessibility of the larger region, assuring housing and transportation to meet the population growth; improvement of co-operation with regions and improvement of co-ordination between different types of public and goods transportation; improvement of regional accessibility and level of well being; improvement of accessibility to environmentally-friendly transport services; development of an effective, integrated, safer, environmentally-friendly, high-quality accessible transport system);
- **Urban issues** (environment and sustainable urban development; strengthening the urban transport network; urban development and secondary transport networks; urban public transport);
- **Traffic safety** (implementation of engineering measures for traffic safety; improvement of safety standards to reduce accident rates and congestion in the TEN-T network);
- **Mobility** (facilitation of the population mobility; increasing sustainable mobility by means of modal integration (road, rail and metro) and by encouraging the widespread use of forms of transport which have a reduced environmental impact (car pooling, car sharing, road pricing, etc.); improvement of mobility in metropolitan areas);
- **Transport networks** (improvement of logistics connections, including ICT connections; stimulation of innovation within and between logistic chains and attracting new logistic businesses; developing combined transport; extending regional and trans-European road links; integrating regional roads into the international road networks; adaption of Trans-European Transport network (TEN-T) to growing traffic intensity; integration of transport and spatial development plans);
- **Transport infrastructure** (specific infrastructures for sustainable growth; improvement of infrastructure in the areas of rail connections, transport in urban areas and intermodal integration; improvement of technical parameters of transport infrastructure; development of regional water transport infrastructure (improvement of utilization potential of seaports; improvements of ports and its motorway, including actions for a better traffic management)**;** development of land transport infrastructure; development of infrastructure capacities of international airports; support to the development of cycling tracks; connections of the regional transport network with the national and international networks, in particular with the TEN-T; improvement of the regional, as well as local transport infrastructure; construction of an intermodal railway station at an airport; widening of motorways and reserving lanes for public transport; sustainable transport and strategic infrastructure);
- **Energy savings / renewable energy** (support to the promotion of energy savings and renewable energies; supporting energy and electricity projects; promotion of more efficient energy consumption; maintenance (aircraft, cars, ships));

- **Environmental impact of transport** (encouragement of environmental-friendly transport; application of environmentally-friendly solutions to increase transport accessibility of the region; improve the safety and increase mobility of the region's residents; development of multimodal and environmentally-friendly transport; reduction of the negative impact of road traffic congestion; reduction of atmospheric and noise pollution levels).

In addition, increased levels of R&D activity and knowledge transfer between research institutions and businesses in transport technologies can also be found among priorities of OPs. It is obvious that several areas could not be clearly assigned to one of the transport related aspects. Areas listed under the Accessibility, Urban issues and Mobility are particularly interlinked. The similar case is with Transport Networks and Transport Infrastructure aspects. Environmental impacts are clearly visible in any other aspect.

This analysis obviously indicates the difference in importance given to transport research in R&I Strategies of European regions and to transport and its aspects in Regional Operational Programmes. Therefore, in order to overcome these gaps and by taking into account the importance of transport for European industry, it is clear that transport research and innovation activities should be specifically elaborated and much more incorporated in the future R&I strategies and programmes at regional level in Europe.

5. Conclusion

This paper provides a snapshot of innovation capabilities in EU28 and four associated states, i.e. Iceland, Norway, Serbia and Switzerland. Particular emphases were given to the regional perspective of the European transport sector, by making use of diverse data and information sources. It addresses quantitative and qualitative innovation data and different regional indicators and indexes that supplement each other.

The METRIC database, developed within the project, is designed to present the data related to the mapping European regional research & innovation capabilities of NUTS2 regions in EU28 Countries and several non-EU countries (Norway, Switzerland, Iceland). Collected data is stored in the database and could be searched by online application. There are two search modes – basic and advanced. This database and relevant tools aim to assist a number of stakeholders (i.e. regional agencies, etc) in exploring the innovation capacity profile of their (or other) regions. Also, this tool could be used to feed into JRC's i3S platform, assist the EC in getting a snapshot of the innovation for their cohesion fund policy documents, etc.

Further, we analyzed a selection of the programmes and research strategies identified from research work undertaken within the METRIC project. Relevant research and innovation strategies as well as regional operational programmes, approved by the European Commission, have also been elaborated. Transport related priorities in these strategies and programmes have been identified and compared. In this way, we were able to determine what type of innovation is the focus of transport sector, and how this varies across European regions. Significant difference in importance given to transport research in R&I Strategies of European regions and to transport and its aspects in Regional Operational Programmes have been pointed out. Therefore, we may conclude that innovation strategies should take into account or be updated in order to be compatible with the relevant regional Operational Programme, as well as with other regional related documents, such as development strategies, RIS3 requirements, etc.

All these mapping efforts are intended to provide inputs to measurement, comparison and explanation of transport research and the innovation performance of regions. They are also expected to contribute to the process of identification of types of innovative regions and provide insights into appropriate indicators and regional dimensions of transport innovation roadmaps. All these activities are among objectives of the METRIC project.

It is clear from this deliverable and the results of the mapping process of regional RTDI frameworks that transport innovation are, in most cases, not autonomous, but evolve as response to the structures and purposes of societal milieu in EU member states, associated states and their regions in which the transport system operates. Further analysis of the transport innovation processes requires models of change that describe the evolution of an entire European transport system, and that are consistent with the special characteristics of the regional transport sector. However, improved data sources are needed to study how transport related research and innovation programmes are coordinated and how they could be interlinked across Europe at national as well as regional levels. It is obviously a direction for future researches in this area. This task will require a high level of cooperation among research projects, relevant authorities, research organizations and industry.

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